Compás
capacitación e investigación

INTERCONNECTED FUTURES:
RESEARCH CONTRIBUTIONS ON
SUSTAINABILITY, EQUITY, AND TECHNOLOGICAL TRANSFORMATION



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Interconnected Futures: Research Contributions on Sustainability, Equity, and Technological Transformation

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Guayaquil - Ecuador
www.grupocompas.com
http://repositorio.grupocompas.com

First edition, 2025

ISBN: 978-9942-53-127-8
DOI: 10.31876/9789942531278
URL: http://142.93.18.15:8080/jspui/handle/123456789/1392
Online distribution
Open access

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Prologue

Global Challenges and Local Responses: Pathways to Sustainable and Inclusive Development transcends the mere cataloguing of studies to become an essential milestone in the body of contemporary research on sustainability. In my role as academic coordinator, it gives me a deep sense of responsibility and privilege to present this vast compendium of knowledge, a selective and rigorously curated confluence of analytical and empirical knowledge from prestigious institutions of higher education and research centers strategically distributed across the heterogeneous geographical spectrum that unites and at the same time distinguishes America and Europe. This book, which is presented as an advanced cartography of the most cutting-edge research praxis, not only documents the generation of knowledge on development but also, in an act of social and epistemic commitment, crystallizes the institutional will of these universities to socialize results that should directly impact the formulation of science-based public policies, the reconfiguration of international regulatory frameworks, and, crucially, the necessary metamorphosis of higher education and extension programs. The intrinsic high quality and methodological coherence of the works compiled here are not fortuitous; they are the verifiable corollary of a strategy of quality assurance and scientific rigor that underscores the unquestionable commitment of each participating institution to academic excellence and its dissemination.

The course of this new century has dramatically intensified the systemic and multifactorial interdependence of human societies, demonstrating with empirical force that the crucial challenges defining our era—from anthropogenic global warming and the atavistic persistence of structural inequality, to the management of health crises with pandemic potential and the accelerated erosion of democratic precariousness—are inherently global phenomena in their complex genesis, rapid cross-border spread, and reverberating systemic effects. However, and this principle constitutes the conceptual and unifying leitmotiv that articulates the thematic diversity of the book, the effective solution, the operational, resilient, and, above all, transformative response, is inexorably anchored and materialized in the rigorous contextualization and endogenous mobilization of local and territorial capacities and resources. This book, therefore, is heuristically organized around the dialectical and productive tension that arises between the global scale of the problem and the local scale of the solution, a framework that has forced researchers to transcend the simplistic dichotomies of classical development theory. The chapters selected here operate a categorical distancing from simplistic universalist narratives and top-down development models in order to embrace the complexity inherent in adaptive socio-ecological systems. The fundamental premise is established that sustainable and inclusive development should not be conceived as a predetermined prescriptive model or an immutable static goal, but rather as a dynamic, endogenous, and co-constructed process, whose trajectory is deeply shaped by historical, cultural, political, technological, and ecological factors specific to each territory under study.

The methodological approach implicit and explicit in each of the chapters therefore requires a fundamental change in the intervention paradigm: it is necessary to move from the reactive search for isolated and sectoral technical solutions to the proactive construction of capacities for systemic resilience, self-organization, and social and technological co-innovation. The environmental crisis, for example, is addressed here not only from the perspective of bioengineering or technological decarbonization, but also from complementary angles such as the sociology of vulnerability, circular economy models with an unavoidable focus on distributive equity, comparative environmental law, and the analysis of complex territorial governance systems that seek to integrate multiple levels of decision-making and the active participation of non-state actors. This inherently multidisciplinary and transdisciplinary perspective is the conceptual backbone of the work, providing a robust and flexible analytical framework that allows for the interconnection of the various contributions. At the same time, the very concept of Sustainable Development (SD), although framed within the operationality of the

2030 Agenda, is an analytical construct subject to constant scrutiny. The authors of this book, however, approach it with an analytical rigor that rescues it from abstraction, arguing, through the presentation of rigorous empirical evidence, that SD is only viable, ethically defensible, and durable if it is anchored in radical and multidimensional inclusivity. This redefinition of inclusion goes beyond superficial metrics of gender equity or the simple reduction of monetary poverty; it extends, and here lies one of the most significant contributions of this volume, to epistemic inclusion, which involves the recognition, validation, and integration of the intrinsic value and practical utility of traditional knowledge, local wisdom, and, fundamentally, the empowerment and active participation of historically marginalized actors in the design, deliberation, and implementation of territorial responses and solutions.

The thematic complexity of the title and the geographical and institutional diversity of the contributors, which includes the representation of multiple academic traditions (Anglo-Saxon, continental European, and Latin American), imposed the need for an editorial process of unwavering methodological rigor, which constitutes the second fundamental and irrefutable guarantee of the high quality of this publication. The gestation of this book began with a highly targeted Call for Papers and Pre-Selection Phase with very strict eligibility criteria, inviting contributions exclusively from researchers with a verifiable track record and the ability to provide original empirical evidence or substantial theoretical developments. Each pre-accepted manuscript was critically evaluated by a minimum of two, and in cases where complexity warranted it, three specialists with international recognition in the specific discipline of the chapter. The evaluation criteria applied by the reviewers went far beyond formal correctness, focusing primarily on Originality and Epistemic Contribution and Methodological Soundness, ensuring that the methodology used was appropriate and executed with the utmost rigor. Manuscripts that received a recommendation of Acceptance with Major Modifications underwent an intensive iterative process with the coordination, where the editing not only corrected style and uniformity, but also worked hand in hand with the authors to enhance argumentative clarity and conceptual precision. The task of harmonizing academic voices from multiple backgrounds and research traditions was an intellectual and philological challenge that was approached with absolute meticulousness. The end result of this rigorous quality control is a book where thematic and disciplinary heterogeneity coexists with exceptional scientific quality, ensuring that each chapter is a polished piece, capable of withstanding the scrutiny of global academia and serving as a primary and reliable reference in its respective field of study.

The impact of this methodological and editorial rigor is directly and tangibly projected onto the Higher Education and Research Ecosystem, fulfilling the central promise of this work: its content is intrinsically designed to invigorate and modernize higher education and applied research at the international level, serving as irrefutable testimony to the strategic interest of participating universities in socializing their work through channels that maximize its reach and influence. The thematic content, ranging from the Bioeconomy and the Just Energy Transition to Resilient Urban Planning and Digital Social Innovation, offers cutting-edge material that can be immediately integrated into postgraduate (Master's and Doctorate) curricula in crucial areas such as International Development, Environmental Sciences, Public Policy, and Sustainability Studies. This book provides a rich vein of concrete and comparative case studies that allow university students to transcend abstract theoretical models and confront the complexity of practical application, establishing itself as an indispensable reference resource for research-based learning (RBL). Likewise, by bringing together the work of researchers from universities on different continents, the book serves as a map of scientific capabilities, identifying synergies and complementarities that facilitate the organic emergence of new lines of inter-institutional research and the formation of consortia for applying for large-scale international funding. This commitment to socialization in a high-quality book demonstrates the participating institutions' deep connection to University Social Responsibility (USR), understanding that the knowledge generated must be returned to society in formats that fuel informed public debate, evidence-based decision-making, and global civic awareness. Through this publication, the university reaffirms its role as a driver of change and agent of social transformation, putting its best work at the service of solving the most

pressing challenges of our time.

The creation of "Global Challenges and Local Responses" has been an exercise in complex coordination, a manifesto of scientific rigor, and a demonstration of faith in the transformative power of transatlantic academia. With the certainty that this volume will serve as a seminal reference and starting point for academics, policymakers, and students in their respective spheres of influence, we express our deep gratitude to all the authors for their excellence, to the reviewers for their time, and to the institutions for their strategic vision and constant interest in the socialization of high-quality knowledge. We are fully confident that reading and studying this work will catalyze new research questions, challenge existing paradigms, and reinforce the collective conviction that, while the challenges are global and overwhelming in scale, the creative and resilient capacity of local responses, when articulated in an informed, critical, and rigorous manner, chart a discernible path toward the sustainable and inclusive development that the world urgently needs. This book is, in essence, an indispensable analytical tool for informed action, and its most significant impact will be measured by the quality and justice of the social transformations it inspires.

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Messages of discrimination and social inclusion in digital infographics, from the Responsible Communication perspective

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Introduction

In the digital era, social media are key spaces for producing and promoting ideas in the cultural sphere, as well as in political and social contexts. Digital infographics, as a visual resource developed to convey information quickly, have become a powerful tool not only to offer information but also to educate; at the same time, they can be a source to show or reinforce stereotypes. In this context, the representation of discrimination and social inclusion on these graphic materials is relevant, as they can serve as a breaking point to either proliferate inequality or contribute to more egalitarian and diverse communication.

Discrimination, as a systematic practice of exclusion or devaluation of specific social groups, by their gender, ethnicity, sexual or emotional preferences, disabilities, or any other factors (Delgado & Stefancic, 2017), finds its way on social media through visual messages which can be totally explicit or barely subtle. It is common to depict or conceal specific bodies, cultures, or identities in infographics in response to hegemonic logics that perpetuate a dominant vision of the world (Hall, 1997). Given this situation, the visual communication is not neutral; it is full of ideological meanings to alter the social perception of otherness.

On the other hand, social inclusion from a communicational perspective requires creating content not only to recognize diversity but also to actively integrate it, promoting equal participation of all groups in the digital public sphere (Rodríguez, 2001). On this basis, designing accessible infographics with cultural sensitivity and the representativeness of diverse realities can contribute to more inclusive communication, particularly when viewed from an intersectional perspective and a human rights framework.

Recent research has demonstrated the importance of visual alphabetization as a tool for questioning discriminatory speech on graphic media (Serafini, 2014). This alphabetization implies that producers and consumers of digital content develop the ability to read, interpret, and evaluate visual messages with a conscious awareness of their political and social context.

Infographics that incorporate an inclusive focus not only defy stereotypes but also open spaces to alternative narratives that make visible groups who have been historically marginalized.

From Theory of Social Communication, social media are not channels for information transmission but spaces to build, in a symbolic way, the common sense. Subsequently, designing and sharing infographics with a social inclusion perspective represents a real action to exercise communication as a transformative praxis (Freire, 1970). The reflection on these visual practices can help create a more just, plural, and democratic digital environment.

Responsible Communication perspective

Responsible communication is a concept that has been increasingly addressed in recent years. Several researchers recognize this perspective on communication as a starting point for encouraging audiences to recognize the influence of the emission and dissemination of messages, especially in an increasingly interconnected environment through digital media (Barrientos-Báez *et al.*, 2023; Rincón Quintero *et al.*, 2019; Tapia-Carreto *et al.*, 2022). At the same time, this form of communication is needed to promote the ethical use of language, generating more just and equitable communities (Campesato, 2023; Ramírez Molina *et al.*, 2025). Furthermore, this perspective is, of course, crucial to promoting and spreading a fairer way of communicating within the framework of respecting and promoting human rights.

In this research, responsible communication is defined as the practice of engaging in ethical, honest, transparent, and empathetic discourse with recipients, considering their context and needs, so that the information they receive is useful, accurate, and verifiable (Hernández-Flores *et al.*, 2021). From this perspective, some basic features that this type of communication must address have been proposed, and they are described in Table 1.

Table 1. Responsible Communication Traits

Traits	Description
Honesty	It involves verifying the information provided by the issuer, as well as the sources cited.
Empathy	Respect for the recipients, considering their context and specific needs when sending a message
Transparency	Share the necessary information about what the sender does to build a positive and solid perception with the receivers.
Interactivity	Dialogic communication involves the sender contributing and considering the feedback provided by their audiences to address their needs and make the necessary changes.
Consistency	Coherent and sustained discourse that prioritizes values and professional ethics as the basis for communication.

Source: Own elaboration based on Hernández-Flores *et al.* (2021).

Mexican context of discrimination and social inclusion

In Mexico, discrimination is a persistent phenomenon that profoundly impacts diverse social groups, especially indigenous communities, people of African descent, women, people with disabilities, the LGBTQ+ population, and migrants. Despite progress in legislation and human rights on paper, in daily life, structural inequality gaps continue to reproduce conditions of exclusion and symbolic and material violence.

The National Survey on Discrimination (ENADIS, 2022) reveals that 23.7% of the population aged 18 and over reported having been discriminated against in the past year for reasons such as their clothing, skin colour, weight, sexual orientation, or gender. This data highlights that discrimination continues to be a common and often normalized practice in diverse areas, including work, education, healthcare, and access to justice (Instituto Nacional de Estadística, Geografía e Informática, 2023).

Structural racism is also present. As Moreno Figueroa and Saldívar (2015) point out, in Mexico, racism is normalized and often denied, which prevents us from recognizing its concrete impacts on people's lives. This is related to a colonial legacy that has hierarchized minds, bodies, and cultures, privileging white and Western values over Indigenous, Afro-descendant, or "common sense".

Indigenous women face an intersectional form of discrimination, subject to multiple forms of oppression simultaneously. According to Lagarde (2005), discrimination against Indigenous women combines racism, sexism, and poverty, reproducing their social and economic exclusion. This situation

worsens when they attempt to access basic services, justice, or political representation.

Furthermore, institutional discrimination, which the State exercises, has also been highlighted by international organizations. The Committee on the Elimination of Racial Discrimination (CERD) has urged the Mexican State to adopt effective measures to combat discriminatory practices in public and private institutions and to guarantee a culture of substantive equality (United Nations, 2019).

In short, discrimination in Mexico is not an isolated phenomenon, but a structural manifestation of historical and contemporary inequalities. Combating it requires recognizing its existence, highlighting its multiple forms, and promoting inclusive public policies with an intercultural, gender, and human rights approach.

The 80 digital infographics observed were published between October 19, 2024, and March 31, 2025. On average, infographics on hate speech were published every two days during this period. Additionally, hashtags such as #JuntosYTranformando (#JoinAndTransform), #EsTiempoDeMujeres (#It'sTimeForWomen), #ViolenceFreeChildhood, #InclusionParaTodos (#InclusionForAllPeople), #MexicoEsInclusion (#MexicoIsInclusion), and #SomosIguales (#WeAreEquality) were included. Furthermore, 67% used a persuasive tone to convey the desired message, while the remaining 33% used an informative tone. Multidirectional communication was encouraged in 53% of the pieces. The interaction fostered is shown in Table 2

Table 2. Social media metrics of the observed pieces

Statistical	Comments	Shared times	I like	I love	I am surprised	I care	It makes me sad	It makes me angry
Total	166	1,069	1,241	423	7	94	41	8
Mean	2.08	13.36	15.51	5.29	0.09	1.18	0.51	0.10
Min	0	0	0	0	0	0	0	0
Max	52	96	113	100	2	16	30	2

Total: It is the total sum of the number of observed elements

Messages about non-discrimination and social inclusion

To narrow down the observed pieces, the messages addressed in the digital infographics on hate speech were established. Half of the pieces referred to the use of stereotypes and prejudices that foster this type of discourse. Another topic also addressed was the intention to harm others, derived from hateful messages—in three out of ten infographics. Finally, two out of ten pieces addressed how hate speech is spread.

It is important to notice that only 38% of the pieces include images that reflect the country's diverse population, and 43% use colours associated with disadvantaged groups. Additionally, 5% of the pieces were written using inclusive language.

Responsible Communication level in infographics

A key point for this research was to determine the level of Responsible Communication presented in the observed pieces, based on the features proposed by the perspective. Table 3 shows that 80% of the pieces meet only one of the features, while the rest meet two or more features. In percentage terms, the most perceived feature in the pieces is empathy (100%), followed by transparency (15%) and honesty (4%).

Table 3. Assessment of the level of Responsible Communication implemented in the observed infographics

Number of traits observed	Fq.	Responsible Communication Level
One trait	64	Very Unresponsible
Two traits	16	Few Responsible
Three traits	0	Moderately Responsible
Four traits	0	Responsible

Fq: total number of infographics with the trait/traits observed

Infographic content used to communicate about hate speech

It stands out, positively, that the design of most infographics (80%) is balanced in terms of textual information and images referring to hate speech. In addition, short and declarative titles (70%) and figurative illustrations (49%) were implemented, which help to capture the recipient's attention easily. However, little emphasis is placed on the consequences of this type of discrimination discourse, as fewer than 5% of the incidents refer to the experiences of the victims or the social consequences that this type of message entails.

Conclusions

Discrimination and social inclusion, along with the mechanisms and supports that can be developed to counteract them, are a source of evaluation and socialization. This is especially true if we consider that expressions of hate not only involve the verbalization of a person's feelings, but also the very structure of values that each individual holds regarding their peers and their characteristics. This structure thus affects not only what they express but also the possible actions they may take, based on their beliefs, which can lead to violent behavior (Marques, 2023).

Furthermore, there is a great debate about who should regulate and even prohibit the use of hate speech, given that neither the state itself nor its political representatives have the moral standing to be a trustworthy agent for these purposes (Howard, 2017; Nusbaum, 2019). However, it must fulfill its role of providing security and promoting equality in the context of democratic societies, as is the case with CONAPRED, a government agency.

Thus, communication pieces, such as infographics, should not only address discrimination speech but also encourage reflection among the various senders and receivers, so that there is self-regulation to refrain from issuing harmful messages of threat, harassment, and offense toward other groups or individuals with whom they do not share their affinities or values (Howard, 2019).

On the other hand, the messages about discrimination and social inclusion expressed in the digital infographics still have areas for improvement. From the perspective of Responsible Communication, while they are expressed with empathy, they still need to address some fundamental characteristics for their credibility, such as transparency and honesty. In this sense, it is essential to provide substantiated and validated information on what inclusion entails (Asprona, 2025), as this positions the information unit as reliable and worthy of consultation and sharing. Furthermore, when correct information is shared, it can counter myths and social prejudices (Tobías Emanuel, 2021).

This research focused on evaluating the messages of discrimination and inclusion in digital infographics, from the perspective of Responsible Communication. Therefore, the focus of the study was from the issuer's perspective. However, as future lines of research, it will be necessary to follow up on other communicative pieces from the same issuer to validate whether the same trend in structure and content of the messages is followed. On the other hand, the communicative pieces must be subjected to an evaluation with the receivers, that is, to understand how they are decoding these

messages, their reaction to them, and whether these contents are sufficient to meet their information needs.

Responsible Communication helps organizations craft messages more effectively, with a focus on social inclusion and human rights. Thus, the audiences and social groups discussed in the communicative pieces are treated with respect, dignity, and the corresponding media representation and responsibility. At the same time, the application of this perspective contributes to improving citizens' perceptions of the social conditions of the different groups that make up the community, promoting a more respectful, equitable, and fair coexistence aimed at fostering a more democratic society.

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Artificial Intelligence and Sustainability: A Decolonial Comparative Law Perspective from Latin America

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Introduction

The rapid expansion of artificial intelligence (AI) in Latin America presents significant environmental challenges due to the considerable energy consumption and electronic waste generated by its use. From a decolonial perspective, this paper explores how constitutional advancements in Latin American countries such as Ecuador, Peru, and Colombia can provide an effective framework to regulate AI and mitigate its ecological impact. This analysis is complemented by a review of international initiatives, with the aim of proposing specific regulations that align with the realities of the Global South

International Context: Europe, the United States, and China

UNESCO has stated that AI has the potential to generate significant negative impacts on the environment. For this reason, Member States and companies should evaluate both the direct and indirect environmental impact, the carbon footprint, energy consumption, and the environmental toll of extracting the raw materials required for manufacturing these technologies. In its Recommendation on the Ethics of Artificial Intelligence, guidelines 17 and 18 establish that the development of AI systems must recognize, protect, and promote the well-being of the environment and ecosystems, as they are essential for human life and that of other living beings. Furthermore, all actors involved in AI must comply with existing environmental laws and reduce their ecological impact by promoting sustainable practices and avoiding the unsustainable exploitation of natural resources (UNESCO, 2023).

The above highlights the importance of incorporating environmental sustainability as a guiding principle at every stage in the development of artificial intelligence systems. It emphasizes that the environment and ecosystems are not only assets that deserve protection in their own right, but also constitute the indispensable foundation for human life and other species. Therefore, they are a necessary condition for benefiting from technological advances. Likewise, the document underscores the need for all actors involved in the AI value chain to comply with international and national regulations, including principles such as the precautionary principle, aimed at ecological protection and sustainable development. A clear call is made to reduce the carbon footprint of these technologies, prevent negative impacts such as climate change, and avoid the unsustainable exploitation of natural resources, aligning technological progress with global conservation objectives.

Similarly, the United Nations has pointed out that large-scale implementations of artificial intelligence, mainly operated in data centers managed by cloud service providers, generate significant environmental impacts. The manufacturing of the electronic equipment used—such as a computer weighing just 2 kg—can require up to 800 kg of raw materials, and the microchips used in AI contain rare earth elements whose extraction is often highly polluting, according to the Navigating New Horizons report. Additionally, these centers generate electrical and electronic waste that contains toxic

substances such as mercury and lead, which are hazardous to both human health and the environment (PNUMA, s.f.).

Additionally, water consumption by data centers is substantial, as it is used both during construction and later in their cooling systems, which are essential for keeping their electronic components operational. It is estimated that, on a global scale, infrastructure related to artificial intelligence could consume up to six times more water than the entire country of Denmark, a nation with a population of approximately six million. This represents a concerning challenge, especially considering that one-quarter of the world's population still lacks adequate access to safe drinking water and basic sanitation systems (PNUD, s.f.).

The operation of AI data centers requires high energy demand, mostly sourced from fossil fuels, which worsens climate change. A single ChatGPT query consumes ten times more electricity than a traditional Google search. The International Energy Agency (IEA) estimates that in Ireland, these centers could consume up to 35% of the country's total energy by 2026. This growth raises serious environmental concerns (PNUMA, s.f.).

As a result of the rapid development of AI, the number of data centers has increased substantially, rising from approximately 500,000 in 2012 to around 8 million today. Experts predict that technological demand on the planet's resources will continue to grow in the near future. (PNUD, s.f.).

Europe is leading significant efforts to regulate the environmental impact of emerging technologies such as artificial intelligence (AI). Recently, the European Parliament and the Council of the European Union enacted Regulation (EU) 2024/1689, which establishes a uniform legal framework for the development and use of AI systems within the EU (European Parliament and Council, 2024). This regulation states that AI systems should be developed and used in a sustainable and environmentally respectful manner, for the benefit of all human beings, while also being monitored and evaluated for their long-term effects on individuals, society, and democracy. The application of these principles should be reflected, whenever possible, in the design and use of AI models.

In this regard, to ensure that AI leads to positive outcomes, the following recommendations are made (European Parliament and Council of the European Union, 2024):i) Member States are encouraged to support AI projects with social and environmental benefits, prioritizing those that promote accessibility, reduce inequalities, and meet environmental goals, through public and EU funding;ii) Projects should be developed through effective collaboration among AI experts and specialists in equality, accessibility, consumer rights, environmental protection, digital rights, and academia; and iii) The environmental impact of AI must be assessed and reduced by applying techniques that ensure energy efficiency in its design, training, and deployment.

Likewise, the EU has implemented policies aimed at transitioning toward a green economy, including legislative measures for reducing carbon emissions and implementing carbon pricing. These policies seek to accelerate the development of the digital single market and empower citizens and consumers, with the transformative goal of achieving Europe's "Digital Decade" (Banco de España, 2024). For example, Spain, as a member state of the EU, has implemented the National Program for Green Algorithms, which aims to promote the sustainable use of high-capacity computing resources and artificial intelligence. This program aligns with the EU's objectives of fostering environmentally sustainable and resource-efficient AI. (Ministerio de Asuntos Económicos y Transformación Digital, 2022).

In the United States, although technology regulation has traditionally not focused on the specific environmental impact of AI, recent initiatives have begun to recognize its importance. At the federal level, the *Declaración de Derechos sobre IA* issued in 2022 by the Biden administration (2021–2025) indirectly mentions the need to consider environmental impact in the development of emerging technologies (The White House, 2022).

Federal states such as California have moved more clearly in this direction. The law Privacidad del Consumidor de California (CCPA), although primarily aimed at protecting personal data, indirectly encourages more environmentally responsible practices by limiting large-scale data storage and processing—activities that are highly energy-consuming (State of California Department of Justice, 2018). U.S. case law, such as Carpenter v. United States (2018), has increased awareness of technological surveillance, though it still does not explicitly address the direct environmental impacts of AI.

Subsequently, in 2024, the Artificial Intelligence Environmental Impacts Act de 2024 was enacted with the aim of evaluating, mitigating, and disclosing the environmental effects stemming from the use and development of AI technologies in the United States. This legislation states that the Environmental Protection Agency (EPA) must conduct a comprehensive study, in collaboration with other federal agencies, to assess energy consumption, water usage, pollution, and electronic waste associated with the lifecycle of AI models and systems. This study must be presented four years after the enactment of the law by the National Institute of Standards and Technology (NIST), the EPA, and the Department of Energy.

This regulation is important because it acknowledges that the intensive use of AI is driving a rapid increase in energy consumption and the use of natural resources. It also recognizes both the environmental benefits of AI (such as energy optimization or climate monitoring) and its risks (such as increased electronic waste and carbon footprint), and it is considered essential to promote the responsible development of AI with a focus on sustainability and environmental justice (U.S. Congress, 2024).

Finally, in China, the environmental impact of AI is strategically addressed within the country's national technology development framework. The 2017 National Artificial Intelligence Strategy explicitly considers sustainability as one of its essential pillars, promoting technologies that are resource-efficient and low in emissions (State Council of China, 2017); it establishes that "the development of Artificial Intelligence technologies shall be promoted by ensuring notable energy efficiency and encouraging the manufacturing of devices and equipment with greater environmental awareness" (BCN, 2017)

Recent laws, such as the Data Security Law (DSL) and the Personal Information Protection Law (PIPL), although primarily focused on security and state control, also exert an indirect influence by strictly regulating digital infrastructure, thereby contributing to the optimization of technological resources and the reduction of the environmental impact of large data centers (National People's Congress, 2021).

Decolonial Law – A Perspective from South America

The methodology of comparative law has reinforced a hierarchical view among legal systems, classifying some as "mother legal systems" and others as "children," the latter considered mere reproductions lacking their own innovation (Zweigert & Kötz, 1996). This classification has favored a Eurocentric perspective that legitimizes only the legal systems of former colonizing countries (with the exception of the U.S.). In response, critical and decolonial schools of thought have challenged this hierarchy from postcolonial perspectives, influenced by authors such as Edward Said, Homi Bhabha, Gayatri Spivak, Roger Merino, and Daniel Bonilla (Bhabha, 1994, 2006; Morris & Spivak, 2010; Said, 2019; Bonilla Maldonado, 2022).

From this critical perspective, decolonial comparative law seeks to dismantle colonial vestiges and propose methodologies that avoid forms of unequal legal integration (Tapia, 2016). Through constitutional studies from the Global South, a methodology applicable to private law is proposed, based on Latin American approaches focused on environmental justice. This vision is reflected in the new constitutionalism of Ecuador, Peru, and Colombia—countries that have strengthened the protection of nature and community rights.

Before addressing these developments, it is important to highlight the limited regulatory treatment of the environmental impact of artificial intelligence (AI) in Latin America. A recent effort is the Declaración de Montevideo sobre Inteligencia Artificial y su Impacto en América Latina (Fundación Sadosky, 2023), which emphasizes that AI should be designed to do no harm and to minimize its environmental footprint. In Chile, the Política Nacional de Inteligencia Artificial establishes objectives such as using AI to address climate change (Ministerio de Ciencia, Tecnología, Conocimiento e Innovación, 2021). It has been warned that the energy consumption of AI systems could account for up to 50% of global electricity usage by 2030 (National Institute for Research in Digital Science and Technology, 2020).

In Colombia, AI is used to optimize natural gas transportation, reducing the carbon footprint (Agencia de Noticias UNAL, 2023). In Peru, both the private and public sectors apply AI in services, logistics, facial recognition, and energy management (Secretaría de Gobierno y Transformación Digital, s.f.). In Ecuador, AI is applied in logistics, agriculture, and citizen services, guided by the Agenda de Transformación Digital 2022-2025 (Ministerio de Telecomunicaciones y Sociedad de la Información, 2022).

The low level of environmental regulation of AI stands in contrast to the significant progress in environmental law in the region. Ecuador was a pioneer by enshrining the rights of nature in its 2008 Constitution (Asamblea Nacional Constituyente, 2008), supported by decisions such as ruling 218-15-SEP-CC and the Río Vilcabamba case (Corte Constitucional del Ecuador, 2015; Gudynas, 2011). Peru has protected Indigenous rights through the Ley de Consulta Previa (Ley N.° 29785) and rulings such as STC Exp. N.° 00022-2009-PI/TC (Congreso de la República del Perú, 2011; Tribunal Constitucional del Perú, 2009). Colombia has judicially recognized the rights of nature: the Atrato River was declared a subject of rights in ruling T-622 of 2016, and the Amazon was protected in STC4360-2018 (Corte Constitucional de Colombia, 2016; Corte Suprema de Justicia de Colombia, 2018).

In summary, Ecuador, Peru, and Colombia have made significant progress in building robust environmental legal frameworks, with constitutional and judicial recognitions that promote sustainability and could serve as a foundation for the future environmental regulation of AI.

Sustainable Artificial Intelligence (AI): A Proposal from the Global South

Artificial intelligence (AI), more than a technological abstraction, is a deeply material phenomenon—based on natural resources, energy, human labor, and physical infrastructure (Crawford, 2022). This perspective reveals that AI systems are not neutral but respond to dominant interests due to the high levels of capital investment they require. This reality poses two fundamental challenges for Latin America: on one hand, the lack of domestic investment perpetuates dependency relationships with countries of the Global North; on the other, weak regulation makes the Latin American region an attractive, though vulnerable, location for establishing infrastructures that threaten environmental resources.

In this context, Latin America has become a preferred destination for installing data centers, drawn by low energy costs and lax environmental regulations (PUCP, s.f.). According to the International Energy Agency, a single ChatGPT query may consume up to ten times more energy than a conventional search, raising serious environmental concerns. In response to this reality, the region urgently needs a robust regulatory framework to limit the ecological impacts of these technologies.

Environmental regulation of AI must be built upon the normative advances of Latin American environmental constitutionalism, especially in Ecuador, Peru, and Colombia—countries that have made important strides in recognizing the rights of nature and of communities. In Ecuador, the 2008 Constitution recognizes nature as a subject of rights, establishing that any activity, including technological ones, must respect, restore, and maintain ecological balance (Asamblea Nacional

Constituyente, 2008). The ruling on the Vilcabamba River reaffirms this vision by protecting an ecosystem from the impact of infrastructure development (Gudynas, 2011).

Peru, in turn, contributes with the *Ley de Consulta Previa* (Law No. 29785), which protects the rights of Indigenous communities against interventions that could affect them (Congreso de la República del Perú, 2011). This law could be adapted to require mandatory consultation with communities before developing AI systems with significant environmental impact. The jurisprudence of the Peruvian Constitutional Court also reinforces this approach by recognizing the right to a healthy environment as a fundamental right (Tribunal Constitucional del Perú, 2009).

Colombia has been a pioneer in the legal protection of ecosystems. The Constitutional Court, in ruling T-622 of 2016, recognized the Atrato River as a subject of rights, and in 2018 the Supreme Court extended this protection to the Amazon (Corte Constitucional de Colombia, 2016; Corte Suprema de Justicia de Colombia, 2018). These decisions inspire the possibility of granting special status to ecosystems threatened by technological developments, requiring their promoters to undertake clear conservation obligations.

In addition, Chile's experience with its *Política Nacional de Inteligencia Artificial* offers valuable lessons. Objective 2.7 of this policy promotes the use of AI to address climate change through systems that are responsible and energy-efficient (Ministerio de Ciencia, Tecnología, Conocimiento e Innovación, 2021). In this vein, the regional regulatory framework could include legal and economic incentives to promote green technologies and impose penalties on developments that fail to meet minimum sustainability standards.

To ensure the effectiveness of the proposed framework, it is suggested to establish a regional observatory specialized in AI and the environment. This institution could continuously monitor technological advances, assess impacts, provide technical recommendations, and facilitate knowledge exchange among countries in the region.

The *Declaración de Montevideo sobre IA e Impacto en América Latina* also provides key principles, such as the need to design systems from the outset to minimize harm (Fundación Sadosky, 2023). This premise supports the inclusion of precautionary principles in national legislation, prohibiting the implementation of technologies without prior assessment ensuring their environmental sustainability.

It is also relevant to adopt transparency and accountability mechanisms inspired by regulatory frameworks such as Regulation (EU) 2024/1689. This regulation requires developers to produce detailed reports on energy consumption, management of technological waste, and use of water resources—guidelines that could be applied to AI projects in Latin America when promoted by multinational companies.

In conclusion, environmental regulation of artificial intelligence in Latin America must be based on three fundamental pillars. First, the recognition of the intrinsic value of nature and its rights, already enshrined constitutionally and judicially in countries such as Ecuador, Peru, and Colombia. Second, the guarantee of community participation through prior consultation mechanisms, adapted to address the environmental impacts of AI. And third, the implementation of strict technical standards for the evaluation, monitoring, and mitigation of ecological damage, including tools such as impact assessments, periodic reports, and proportional sanctions.

This comprehensive approach would allow Latin America to position itself as a global leader in the ethical and ecological regulation of emerging technologies, demonstrating that technological development can—and must—be compatible with environmental sustainability and social justice.

Conclusions

The implementation of a regulatory framework for artificial intelligence based on the principles of Latin American environmental constitutionalism would not only effectively address ecological challenges but

also strengthen the region's technological sovereignty in relation to the countries of the Global North. It is crucial that such a regulatory framework incorporate inclusive and participatory mechanisms involving local and Indigenous communities, ensuring the respect of their rights and promoting sustainable practices from a holistic perspective. It is important to note that, although this was a more descriptive proposal, it opens the door for a deeper study on the development of AI and its environmental impact—one that reflects the realities experienced in Latin America and may contribute meaningfully to regulation on this issue.

Finally, considering international experience, Latin America has the opportunity to position itself as a global leader in the ethical and sustainable development of AI. To achieve this, the implementation of transparent and rigorous policies is required—ones that continuously assess the environmental impact of these technologies. The creation of specific incentives and the establishment of a specialized regional observatory could ensure technological development that aligns with the values of sustainability and respect for nature, moving toward a more just and equitable future for the region.

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Integration of systemic complexity and information technologies for business strengthening in Colombia

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Introduction

Assuming that the integration of Information Technologies (IT) into business processes is a given in Colombian companies may seem natural in a world that is highly interconnected through digital tools. One might think that all actors are embedded within IT systems. However, the reality for Colombian businesses is different, marked by conditions and limitations inherent to the country's specific characteristics.

The objectives of this research project arise from the need to interpret the systemic approach as a foundational pillar of business innovation and the adoption of a new ecosystem that enhances competitiveness. This study provides a theoretical analysis of how to implement complex thinking in Colombian companies, aiming to explore its potential to enhance organizational understanding and adaptability in complex environments.

From a business perspective, it is essential to understand the multiple variables that affect or benefit organizations, as previously observed in the business ecosystem, which outlines how companies must interact with and interpret the various factors and stakeholders involved. In addition, it is necessary to understand the internal dynamics of organizational structure, as a key component in the interaction of internal processes.

It is important to clarify that, in this study, companies are categorized according to different dimensions based on the scale of IT implementation and its coverage within their operations. It would be inappropriate to evaluate small, medium, and large enterprises using the same parameters of action and focus.

To achieve a structured understanding of the problem addressed, the analytical tool of the problem tree will be used. This methodology "makes it possible to systematically break down the various dimensions of a problem, identifying its causes and consequences through the tree structure" (DNP, 2013, p. 12). The problem tree will serve as a conceptual basis to comprehend the complexities inherent to IT adoption in the business context and its link to competitiveness.

Within this framework, integrating the principles of systemic complexity aims not only to drive efficiency and competitiveness, but also to foster a business culture rooted in flexibility, resilience, and the capacity to embrace change—particularly when it comes to human capital challenges, which may manifest in two forms: displacement by automation or lack of technological education. This proactive approach, aligned with the challenges and opportunities of the Industry 4.0 era, positions companies not merely as followers, but as leaders in the creation and implementation of innovative solutions within the global business landscape. The research structure was developed in three phases: data collection, analysis, and validation—each necessary to answer the research question and achieve the general objective. As indicated by the guiding research question, the applied methodology is exploratory in nature. According to Cimec (2024), "an exploratory study is used when little information is known about the topic being studied" (p. 1).

Cimec (2024) also states that "exploratory studies are suitable when researchers know little about the phenomenon being examined, as they are not limited to a specific paradigm and can be applied using either qualitative or quantitative research approaches" (p. 2). In this case, it is important to recognize that a bibliographic review of scientific databases revealed that Scopus includes approximately 68,000 business strengthening programs published between 2018 and 2024, of which 15,275 are related to the application of Science, Technology, and Innovation (STI). However, only 368 studies attempt to connect these themes specifically to Colombian companies or related economic sectors, which underscores the need for the present research. A bibliographic review was conducted using academic databases, and to date, no business strengthening program has been identified that integrates information technologies with the principles of systemic complexity—highlighting the originality and relevance of this research topic in both academic and business contexts.

The bibliographic review of cases and best practices was conducted using academic databases such as BASE (Bielefeld Academic Search Engine), REDIB (Red Iberoamericana de Innovación y Conocimiento Científico), RefSeek, Ciencia.Science, DOAJ (Directory of Open Access Journals), ERIH (European Reference Index for the Humanities), and Scopus. Additionally, ongoing searches were conducted through the library of the Colombian Ministry of Information and Communication Technologies.

This review provides the theoretical foundation for the study. The information gathered contributed to understanding how companies perceive their competitive capabilities in IT and Industry 4.0 in the Colombian context. The analysis focused on business strengthening programs based on Information Technologies (IT) and/or Industry 4.0, with particular attention given to the inclusion of components related to systemic complexity. The search queries used to retrieve and consolidate information from academic databases were shown in Table 1.

Table 1. *Search equations*

Business Success Stories	("success stories" OR "case studies") AND ("Colombian companies" OR "companies in Colombia") AND ("ICT" OR "information and communication technologies") AND ("last 5 years" OR "past five years")
Business Best Practices	("best practices" OR "successful practices") AND ("Colombian companies" OR "companies in Colombia") AND ("ICT" OR "information and communication technologies") AND ("last 5 years" OR "past five years")
ICT in Colombian Companies	("Colombian companies" OR "companies in Colombia") AND ("ICT" OR "information and communication technologies") AND ("achieved competitiveness" OR "improved competitiveness") AND ("last 5 years" OR "past five years")
Business Strengthening Programs Based on IT	("business strengthening programs" OR "business development programs" OR "entrepreneurial initiatives") AND ("information technologies" OR "IT" OR "digital technologies" OR "computer technologies")

Principles of Systemic Complexity

Identifying the principles of systemic complexity that are aligned with the development of business competitiveness and the use or application of Information Technologies (IT) is a central focus of this paper. Understanding how complex thinking can be used to manage productive processes within organizations provides alternatives to traditional organizational theories.

To begin, it is essential to recognize that systemic complexity is considered "an approach that seeks to understand and address complex systems across various disciplines, which is fundamental in the business context, as it integrates knowledge from fields such as biology, physics, sociology, economics, and others" (Becerra, 2020, p. 16).

Moreover, the principles of complex thinking can be applied to the business context, allowing for the measurement of productivity. Monsalve (2022) states that "establishing a productivity measurement model from a transdisciplinary perspective involves a comprehensive vision that ensures each individual being trained on the subject—and all those interested in it—can gain an integral understanding of the phenomenon, enabling them to make informed decisions in economic or administrative environments" (p. 127).

This highlights the need to integrate the principles of systemic complexity—namely, transdisciplinarity and multidimensionality—into the process of competitiveness and business strengthening based on Information Technologies. Accordingly, this paper seeks to incorporate key concepts viewed through a systemic lens, among which the following stand out: interconnection, adaptability, self-organization, and non-linearity.

The following section outlines the fundamental principles of business competitiveness, which represent the most significant components of this research. It is within this framework that the essential principles are identified—those that organizations must adopt in order to ensure their competitiveness in both national and international contexts is aligned with market dimensions and productive capabilities.

The Enterprise through the Lens of Complex Thinking

Complex thinking and business organizations interact through multiple dimensions, as this approach emphasizes the interconnection and interdependence among the various elements of a system—recognizing that the enterprise is just one actor within a broader system. This perspective is reflected in the following aspects:

Systemic Vision: Complex thinking entails viewing an organization as an interconnected system rather than as isolated parts. This perspective enables a better understanding of how different elements (such as departments, teams, and processes) interact with each other and influence the organization as a whole.

Change Management: Businesses are constantly exposed to both internal and external changes. Complex thinking supports change management by taking into account the multiple elements affected by transformation, thereby facilitating more effective implementation and smoother adaptation.

Problem Solving: Complex thinking encourages integrated approaches to addressing business problems. Rather than relying on linear solutions, it seeks to understand the root causes and interrelationships among various factors in order to develop more effective and sustainable solutions.

Decision-Making: Business decisions often involve multiple variables. Complex thinking helps business leaders consider the interconnections among different factors before making decisions, which can result in more effective and long-term strategies.

Innovation: Innovation within companies frequently arises from the ability to perceive connections between seemingly unrelated ideas. Complex thinking fosters creativity and the exploration of new perspectives, which can drive innovation in products, services, and business processes.

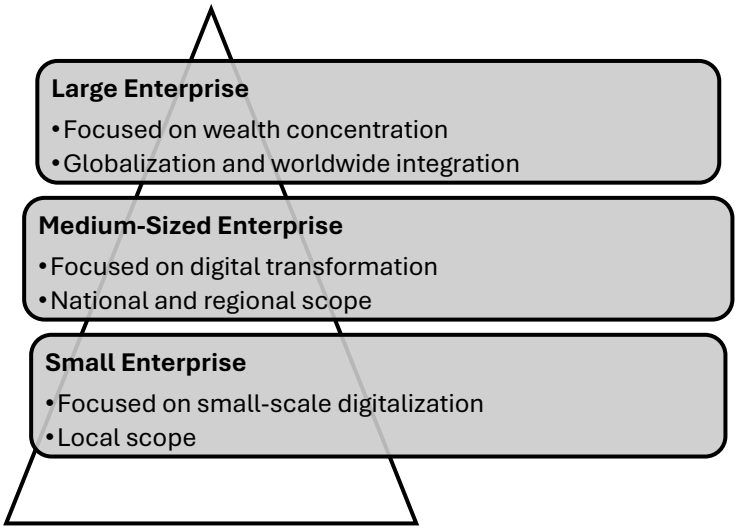
Implementing the Principles of Complex Thinking in the Application of IT in Business

Returning to the foundation of the Fourth Industrial Revolution (4IR), it is defined as "a process in which improving and enhancing decision-making systems in business requires the management and interpretation of data—an action that can only be achieved through the digitalization of Colombian companies" (Schwab, 2017, p. 36).

Although the demands of IT implementation vary depending on the size and capacity of the company,

this does not mean that businesses are disconnected from its fundamental components. It is widely recognized that there is an inherent relationship between IT and business operations. For instance, small Colombian enterprises that use Fintech mechanisms enabling electronic payments via mobile numbers, QR codes, or electronic invoicing systems are already engaging with the foundational elements of the 4IR. This research makes it clear that the distribution and implementation of IT varies according to company size, as follows (Figure 1):

Figure 1. Business categorization.



Source: Own elaboration, 2025.

In this regard, interpreting the systemic approach as a pillar for understanding the business ecosystem and organizational behavior makes it possible to enhance competitiveness, as it emphasizes the interrelationships among various aspects of operations. This includes the implementation of integrated management systems that encompass areas such as supply chain management, human resources, and information technology. It also involves fostering an organizational culture that promotes collaboration, adaptability, and continuous learning—acknowledging that changes in one part of the system may have ripple effects across other areas.

Effectively managing systemic complexity also requires the ability to anticipate and adapt to external changes, such as technological innovations, market fluctuations, and regulatory shifts. By understanding the complexity of their environment, companies can make more informed decisions, identify strategic opportunities, and mitigate potential risks—ultimately enhancing their competitiveness in a dynamic and complex business landscape.

It is important to recognize that organizations heavily depend on efficiency and agility to remain competitive. The incorporation of Information Technologies enables organizations to optimize operations, improve decision-making, and respond quickly to market changes. Moreover, the interconnection of systems and effective data management facilitate internal collaboration, drive innovation, and enable adaptation to emerging technologies. In this sense, IT not only improves operational efficiency but also strengthens a company's market position, ensuring its ability to face challenges and capitalize on market opportunities.

The subsequent sections delineate the key principles of systemic complexity that, when applied within organizations, contribute to the development of a distinctive innovative advantage.

Interconnection

Interconnection, as a fundamental principle of systemic complexity, is the invisible fabric that links the components of a system, granting coherence and enabling the emergence of global patterns and

behaviors. Rather than addressing elements in isolation, this principle recognizes that the true essence of a complex system lies in the dynamic relationships among its parts.

Morin (2009) refers to the systemic approach as "the interconnection and interactions between objects, people, and the environment as a whole, which is essential when considering how companies relate to their surroundings and the actors that influence them" (p. 45). This perspective enables knowledge to be approached in an integrated rather than fragmented way—even when the economic sectors and disciplines involved are entirely different.

Therefore, the process of business competitiveness and innovation must be conceived from a place of awareness, where the company understands itself as merely one component of a broader system—characterized by complexity and constant interaction. Decisions made within subsystems can impact the entire system, and the communication and productive capabilities developed by organizations must be understood through their capacity to comprehend other complex systems, how they interconnect, and how the company operates within these flows of information.

Adaptability in the Organization

Adaptability, from the perspective of systemic complexity, refers to "the capacity of systems to adjust and respond effectively to changes in their external environment or internal conditions" (Morin, 2009, p. 48). This business strategy acknowledges the inherent dynamism of complex systems and the need to evolve and adapt in order to survive and thrive in unstable environments.

For this reason, adaptability is central to this proposal, as it enables an understanding of business through the lens of complexity by integrating tools such as resilience. This means that organizations must be capable of recovering after disruptions while maintaining their productive capacity and market presence. It also includes continuous learning, described as "the ability of companies to learn from experience and adjust their behavior accordingly, allowing them to modify their strategies and improve performance as they interact with their environment" (Londoño-Patiño, 2018, p. 113).

In addition, uncertainty management allows companies to respond effectively and promptly to unpredictable events. From the perspective of complex thinking, "adaptability highlights the importance of an organization's capacity to adjust and evolve in response to change" (Sanguineti, 2010, p. 39). This principle is essential for understanding and addressing the proposal that follows, as it recognizes the dynamic nature of businesses and the need for a flexible and responsive approach to ensure long-term viability and effectiveness.

Self-Organization

Self-organization is a fundamental concept in business strategy from the perspective of systemic complexity. It reveals the inherent capacity of systems to structure and restructure themselves spontaneously, without the need for external direction. This concept challenges the traditional view of systems—often considered mechanical and predictable—by acknowledging that complex systems possess the ability to generate emergent patterns and structures on their own.

In self-organized systems, "the interactions among the individual components of the system give rise to collective behaviors and structures that cannot be predicted simply by analyzing the parts in isolation" (Holland, 2006, p. 98). This phenomenon is especially evident in complex systems that operate far from equilibrium, "where constant flows of energy and materials enable the creation of new forms of organization" (Bertalanffy, 1989, p. 49). This business strategy of self-organization has profound implications for understanding and addressing complex systems. Rather than viewing systems as static and controllable entities, they are recognized as dynamic and capable of generating new organizational forms without direct external intervention. Self-organization is a business strategy rooted in complex systems theory and complex thinking, and it has become a key concept in modern

management. It suggests that companies—like natural systems—"have the inherent capacity to organize and reorganize themselves spontaneously without centralized direction, thereby adapting to a constantly changing environment" (Sanguineti, 2010, p. 116).

In the business context, self-organization involves the emergence of organizational structures and patterns through the interaction and collaboration of organizational members, rather than relying solely on rigid guidelines and hierarchies. This approach seeks to harness collective intelligence and employee creativity, fostering an environment in which innovation and adaptability can flourish.

Other Factors to Consider

Resilience: Organizations must possess the capacity to recover from disruptions and maintain both their productive capabilities and market coverage.

Continuous Learning: This refers to the ability of companies to learn from experience and adjust their behavior accordingly, enabling them to modify strategies and improve performance as they interact with their environment. Undoubtedly, all the factors presented here contribute to strengthening the agility, resilience, and adaptability of organizations. Businesses today must not only stay at the forefront of change but also position themselves as leaders within an increasingly competitive and constantly evolving environment. This comprehensive approach to technological empowerment translates into a strategic advantage that not only boosts internal efficiency but also opens doors to new opportunities, thereby consolidating the organization as a relevant and competitive player in the contemporary landscape.

Conclusions

The integration of systemic complexity principles to enhance the appropriation of Information Technologies represents a fundamental step toward the holistic transformation of business practices. Incorporating these principles provides companies with a robust conceptual foundation to face the complex challenges of the present. By embracing the dynamic nature of Industry 4.0, this approach not only aims to optimize technological operations but also to foster an organizational mindset that values innovation and continuous adaptability for competitiveness. This integrative perspective leads not only to tangible improvements in business efficiency and competitiveness but also lays the groundwork for a more responsive and agile organizational culture. The synergy between systemic complexity principles and the demands of Industry 4.0 creates a favorable environment for experimentation, creativity, and transdisciplinary collaboration. Ultimately, achieving this specific objective not only drives the effective adoption of cutting-edge technologies but also catalyzes a cultural evolution that positions companies as proactive actors and leaders within the dynamic landscape of the current industrial revolution. Furthermore, this study sought to bring small, medium, and large business leaders closer to understanding how complex thinking can inform administrative and organizational concepts to support decision-making, even without advanced knowledge in the field of systemic complexity. For this reason, the strengthening plan presented herein uses language rooted in business and management, enabling the comprehension of key systemic complexity principles essential for innovation and IT implementation, while also connecting with classical and necessary theories such as Michael Porter's value chain.

Despite these contributions, this study presents certain limitations that must be acknowledged. First, the theoretical nature of the analysis means that empirical validation through case studies or practical implementations remains necessary to confirm the effectiveness of integrating systemic complexity principles in diverse business contexts. Additionally, the generalization of findings across different industries and organizational sizes may be constrained by the specific economic, cultural, and technological conditions prevalent in Colombian companies, which were the primary focus of this research. Lastly, the accessibility of the proposed framework to business leaders without prior exposure

to systemic complexity may vary, potentially requiring tailored training programs to ensure full comprehension and effective application.

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Female Leadership as an Alternative Approach to Promoting Equitable, Fair, and Healthy Workplaces

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Introduction

The design of contemporary work environments is increasingly challenged by demands for equity, inclusion, and sustainability. Although the presence of women in managerial positions has grown across various sectors, structural and cultural barriers continue to limit their full participation in leadership roles. In this context, the automotive sector stands out as particularly illustrative due to its deeply rooted masculine tradition and the persistent resistance embedded in many of its organizational practices. Women leaders in this sector face daily gender stereotypes, exclusionary dynamics, and inflexible work structures. These conditions generate tensions between professional development and personal life. However, many of them adopt strategies aimed at strengthening their leadership, such as assertive communication, empathy, and collaborative management—qualities that enable them to foster transformation within their teams and contribute to a more respectful and inclusive organizational culture. Despite the growing discourse on equal opportunities, the ways in which gender dynamics affect the career trajectories of women leaders in automotive agencies remains an underexplored field. This research addresses the following question: What experiences do women in leadership positions within automotive agencies undergo, and how do gender dynamics influence their professional development and their role as agents of transformation toward equitable, fair, and healthy workplaces? The objective of this study is to understand the career trajectories of women in executive roles through semi-structured interviews, exploring the challenges they face and the strategies they have implemented to sustain their leadership and promote more collaborative and sustainable work environments.

This chapter examines female leadership as an alternative to traditional management models in sectors characterized by gender inequality. Using a qualitative and interpretative approach, the experiences of these women are analyzed to identify common patterns and reflect on their impact on organizational culture, staff well-being, and team performance.

Female Leadership and the Disruption of Traditional Models

Female leadership has garnered attention for its capacity to transform organizational dynamics and challenge traditionally vertical structures. Buss *et al.* (2025) highlight that women leaders often adopt styles centered on collaboration, empathy, and collective inspiration. This approach positions leadership as a tool for internal cohesion, distancing itself from models rooted in authority or hierarchical oversight. In contrast to transactional leadership—which prioritizes control and reward systems—female leadership tends to align with transformational models. According to Paustian-Underdahl *et al.* (2024), such leaders promote personal development, relational closeness, and

decision-making grounded in ethical principles, generating positive evaluations that question the relevance of rigid styles. Recent studies have also explored how women attain managerial roles in unequal contexts. Gunes and Chang (2025) demonstrate that, within Turkish organizations, women leaders have navigated their careers through merit-based strategies, by challenging cultural norms, and redefining the notion of authority. In doing so, they establish themselves as alternatives to traditional models that restrict diversity in management. The role of emotions in leadership has also been re-evaluated. Singh *et al.* (2023) assert that integrating emotional competencies fosters resilient and cohesive environments by enhancing decision-making, team interaction, and adaptability. Liden *et al.* (2025) argue that current leadership trends prioritize adaptability, ethics, and inclusion. In this scenario, women leaders emerge as key figures who reshape organizational logic, replacing the centrality of vertical command with more horizontal and dynamic practices.

Gender Stereotypes in Organizational Structures

Organizations incorporate symbolic mechanisms that reinforce gender hierarchies through deeply ingrained stereotypes. These stereotypes, as internalized social representations, shape differentiated workplace expectations for women and men, defining who leads, who follows, and what behaviors are deemed acceptable. Son Hing *et al.* (2023) emphasize that such beliefs influence key processes such as recruitment, evaluation, and reward systems, creating frequent yet often invisible barriers. One manifestation of these dynamics is sexist microaggressions. In their study of the Qatari public sector, Naguib and Madeeha (2023) demonstrate how everyday decisions, gestures, and comments limit women's access to leadership positions. Although not formally codified, these mechanisms diminish advancement opportunities and reinforce the glass ceiling. The distinction between descriptive and prescriptive stereotypes helps clarify how these restrictions are solidified. Manzi *et al.* (2024) explain that women who do not conform to emotionally supportive roles are judged negatively, while those who adopt assertive attitudes are deemed unsuitable for leadership. This double bind creates tension between expected roles and professional conduct. From the perspective of gender role theory, such practices are understood as institutionalized cultural constructs. Philbin *et al.* (2024) indicate that the institutionalization of gender shapes workplace interactions, internal politics, and hierarchical structures, channeling career paths according to pre-established norms. The institutional approach enables identification of how corporate strategic decisions can either disrupt or reinforce these patterns. Nishitani and Kawaguchi (2023) show that in Japan, transparency in promotion processes and increased female representation in top positions are associated with lower levels of bias. These findings underscore that the institutional environment is not neutral, but rather a space where power structures are either reproduced or transformed.

Leadership Strategies for Exclusionary Contexts

Organizations with exclusionary structures require leadership approaches capable of fostering participation and recognition. Empathic leadership—centered on understanding others and managing emotions—has proven effective in such settings. McNulty and Politis (2023) argue that empathy and emotional intelligence enhance functional relationships, strengthens teamwork, and reduces tensions, thereby transforming leadership into a relational process that incorporates diverse perspectives. At a more structured level, inclusive leadership emphasizes active listening, individual recognition, and the creation of psychologically safe environments. Korkmaz *et al.* (2022) explain that this model balances each person's uniqueness with a sense of group belonging, thereby weakening implicit exclusion mechanisms. Assertive communication emerges as a key tool: Zaman *et al.* (2024) highlights that clear, firm, and respectful discourse fosters psychological safety, even in adverse environments. Although it may initially create tension, its connection to resilience supports decision-making aligned with values of inclusion and respect. Support networks and continuous learning enhance leadership adaptability. Carrington *et al.* (2024) examine educational environments where mentoring, professional cooperation,

and shared training enable leaders to confront structural barriers. These practices reshape traditional dynamics and open pathways to collaborative models. The development of soft skills has gained relevance amid technological and organizational transformation. Poláková *et al.* (2023) indicate that qualities such as adaptability, collaboration, and critical thinking increase responsiveness to complex and diverse production models. Taken together, effective leadership in exclusionary contexts is grounded in emotional, communicative, and adaptive competencies, integrated to manage diversity through an open, empathetic, and strategic perspective.

Work-Life Balance and Organizational Sustainability

The relationship between organizational sustainability and workplace well-being has been widely debated, with work-life balance emerging as a central issue—particularly for women in leadership positions. Sahni *et al.* (2025) point out that institutional rigidity—manifested through inflexible schedules, high demands, and limited autonomy—creates tensions that disrupt the balance between professional obligations and private responsibilities, leading to fatigue, reduced performance, and, in many cases, resignation from leadership roles. Furthermore, the literature warns that practices such as teleworking and flexible scheduling, when not accompanied by cultural change, may exacerbate inequalities. Soga *et al.* (2022) note that such measures often intensify women's self-imposed pressure as they juggle employment and domestic caregiving, negatively affecting emotional well-being and altering professional trajectories. Some sectors have proposed more comprehensive responses. Lingard and Turner (2022) document a case in the Australian construction industry where reduced working hours, the elimination of after-hours meetings, and equity agreements led to improvements in organizational health, employee retention, and productivity. Cultural representations also shape women's professional availability. Chen and Dominelli (2022) found that, during the pandemic, female social workers in China faced pressure to extend their working hours under vocational expectations that ignored their personal needs, thereby reinforcing unsustainable labor models. At a global scale, Verma *et al.* (2024) identify effective practices such as shared parental leave, outcome-based evaluations, guaranteed rest periods, and the involvement of women leaders in the development of internal policies. These actions reflect an equity-oriented approach that places quality of life at the center of organizational priorities. Taken together, these findings suggest that work-life balance cannot be addressed solely at the individual level. Institutional rigidity, cultural norms, and organizational structures demand systematic interventions rooted in sustainability and labor justice.

Meanings of Leadership in Male-Dominated Environments

Participants described their leadership as grounded in empathy, active listening, and the cultivation of trust-based relationships. They rejected authoritarian models and favored collaborative management styles. This approach aligns with Buss *et al.* (2025), who point out that female leadership prioritizes team cohesion and horizontal relationships over rigid hierarchical structures. As one executive stated, "I don't impose myself by yelling; I impose myself with arguments. And I think that's why my technicians respect me" [Interview 3]. These experiences break away from traditional transactional models and reflect traits of transformational leadership, focused on collective motivation and ethical commitment, as described by Paustian-Underdahl *et al.* (2024). The interviewed leaders emphasized the importance of leading by example and making decisions based on fairness: "I don't delegate something I don't know how to do. For me, leadership isn't about giving orders—it's about knowing how to support others" [Interview 5]. Several noted that their leadership practices were not the result of formal training but rather adaptations to adverse contexts, which aligns with Gunes and Chang (2025), who observed that women in unequal institutional environments redefine authority through lived experience. Emotionally, they highlighted the importance of managing conflict, mediating across departments, and recognizing team effort as core elements of their leadership style—consistent with Singh *et al.* (2023),

who argue that emotional competencies strengthen resilient leadership with positive effects on organizational culture and employee motivation.

Symbolic Barriers and Structures of Exclusion

The interviews revealed forms of symbolic exclusion that undermine the authority and legitimacy of female leadership. Participants noted that they constantly have to "prove" their capabilities to male colleagues and often face attitudes that discredit their decisions: "Sometimes I give an instruction, and they go confirm it with the male manager, as if I needed approval" [Interview 2]. These experiences echo findings by Son Hing *et al.* (2023), who state that gender stereotypes influence performance evaluations and limit access to positions of influence. Sexist microaggressions appeared in subtle comments and gestures meant to delegitimize, as one participant recounted: "They told me I couldn't handle the position because I have young children… that they should give it to someone with more 'availability'" [Interview 7], consistent with Naguib and Madeeha (2023), who show how structural biases restrict women's advancement based on implicit assumptions of "suitability." The tension between prescriptive and descriptive gender stereotypes also emerged: women with assertive styles were labeled authoritarian, while those with a nurturing approach were confined to caregiving roles, obscuring their strategic contributions. This reflects what Manzi *et al.* (2024) describe as the double penalty women face for deviating from traditional feminine ideals. From an institutional perspective, these practices are not isolated. According to Philbin *et al.* (2024), informal rules and internalized codes perpetuate unequal career paths. In this study, the interviewed leaders confront such structures through individual actions, though without sufficient institutional support to acknowledge or correct these exclusionary mechanisms. Nonetheless, their continued presence, the way they resist daily delegitimization, and their ability to maintain authority reflect a form of tacit managerial resilience, manifesting as a sustained response to adverse environments.

Strategies for Sustaining Leadership

In the face of exclusionary structures and everyday sexist microaggressions, the participants have constructed leadership strategies based on resilience, continuous learning, and relational skills. A key strategy is assertive communication, which enables them to exercise authority without resorting to authoritarianism. "I learned to speak directly, with respect, without hesitation. Because if you hesitate, they'll eat you alive" [Interview 1]. This practice aligns with Zaman *et al.* (2024), who affirm that clear, firm discourse strengthens leadership in adverse contexts and fosters psychological safety within teams. Specialized training also proved fundamental. Several leaders pursued courses, diplomas, and certifications to enhance their professional profiles, legitimize their decisions, and increase their credibility: "I've done what my male colleagues haven't: studied more. So, no one can say I don't know" [Interview 6]. This need for validation echoes Carrington *et al.* (2024), who found that sustained learning enables women to confront structural barriers with greater preparation.

Additionally, participants emphasized the importance of support networks—both internal and external—as spaces for emotional support, mentoring, and symbolic protection. According to Korkmaz *et al.* (2022), inclusive leadership is strengthened when individuals can preserve their uniqueness without losing a sense of belonging. As one interviewee put it: "What has helped me the most is having other women who understand you, who lift you up" [Interview 4]. These strategies not only help sustain female authority in adverse contexts but also shape a form of leadership that is empathetic, collaborative, and situated—transforming management into a relational practice, as argued by McNulty and Politis (2023). While these actions represent effective forms of everyday resistance, they still operate within boundaries defined by organizational structures that require deeper transformations to achieve truly equitable working conditions.

Work-Life Balance as a Structural Dimension

Work-life balance represents a critical structural dimension for the sustainability of female leadership. Participants noted that rigid schedules, high demands for availability, and limited institutional co-responsibility led to prolonged strain, affecting both their well-being and their continuity in managerial roles. This imbalance is rooted in a work model driven by productivity logics that overlook the diversity of life trajectories and external responsibilities. Sahni *et al.* (2025) highlight that such institutional factors directly impact women's ability to remain in leadership positions. Although some organizations have implemented telework and flexible hours, these measures do not always result in meaningful improvements. Soga *et al.* (2022) argue that without a deep cultural shift, such policies may increase women's self-imposed burdens by combining professional and domestic tasks, thereby deepening inequalities. In contrast, evidence from other sectors shows that it is possible to move toward more equitable working conditions through comprehensive policies. Measures such as reduced working hours, elimination of after-hours meetings, shared leave schemes, guaranteed breaks, and the inclusion of women in internal policy design have led to significant improvements in organizational health, talent retention, and institutional co-responsibility (Lingard & Turner, 2022; Verma *et al.*, 2024). Cultural context also plays a decisive role. Chen and Dominelli (2022) found that during the pandemic, female social workers in China experienced symbolic pressure to prioritize vocational duty over self-care, thereby rendering their personal needs invisible. These findings demonstrate that work-life balance cannot be addressed solely at the individual level. Institutional rigidity, cultural norms, and organizational structures require structural transformations oriented toward equity and well-being.

Conclusions

This study provided insight into how women in managerial positions within the automotive sector navigate work structures that have historically limited their participation and visibility. The career trajectories shared by the interviewees reveal leadership styles that challenge traditional vertical models through practices grounded in empathy, active listening, professional preparedness, and collaborative management. These actions emerge as everyday responses to an environment that, while formally neutral, sustains subtle biases and exclusionary mechanisms that constrain female authority.

The narratives reveal that exclusionary dynamics persist through sexist microaggressions, gendered expectations, and hierarchical validations that question the legitimacy of women's leadership. In response to such circumstances, these leaders develop strategies that strengthen their ability to sustain their managerial roles, including the use of assertive communication, continuous professional development, and the creation of peer support networks. These practices enable them to assert a legitimate, ethical, and approachable form of authority that reshapes team interactions and promotes new models of organizational engagement.

One of the most salient cross-cutting findings was the presence of structural tensions between work and personal life. Participants noted that the absence of institutional policies promoting shared responsibility generates prolonged strain and limits the permanence of women in leadership roles. The expectation of total availability, along with the invisibility of their personal needs, constitutes a persistent barrier that undermines well-being and professional development in demanding contexts. This issue cannot be addressed through individual responsibility alone; it requires organizational transformations oriented toward equity, flexibility, and the recognition of the diverse life trajectories present in the workplace.

From an academic perspective, this study offers a situated view of female leadership in a sector that remains underexplored through qualitative inquiry. It articulates structural, cultural, and subjective elements that shape the experience of leading, thereby enriching existing analytical frameworks and offering a deeper understanding of gender dynamics in highly masculinized environments. On a practical level, the findings offer guidance for revising policies related to promotion, retention, and

organizational design, with the aim of fostering workplaces that recognize and value diverse leadership styles.

The voices gathered in this study do not merely reflect individual experiences; they represent transformative practices that resonate with the emerging values of contemporary work environments. Recognizing and supporting these practices entails confronting persistent barriers from an institutional perspective that promotes fairer, more sustainable, and change-oriented labor relations.

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Women's participation in obtaining seed capital for entrepreneurship is greater

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Introduction

In the area of funding for programs that benefit women, non-governmental organizations facilitate this scenario. For example, the Chanel Foundation promotes a series of calls for proposals for projects that seek to consolidate the presence of women in business, art, health, and sports (HW, 2025). The banking sector is also joining this effort; in a Central American context, CABEI (2023) has disbursed around $8 million to strengthen programs that benefit the female community.

The way used to obtain such financing is through entrepreneurship, assumed by MEDFA (2025), to contribute to the empowerment of the female collective, after staging episodes of inequality and lack of opportunities for years. Especially in rural areas, the gap in the labor market is enormous, although with policies for rural development in Mexico, according to Chong-González & Guadalupe (2016), so-called female self-employment and female-led businesses are in fashion.

Now, in Panama the Micro, Small and Medium Enterprise Authority (MSMEA) manages the seed capital program (AMPYME, 2021), and applications to access it are not exclusive to women. Therefore, the purpose of this research is to understand the participation of women in the granting of non-reimbursable funds offered by this institution. Simply promoting an entrepreneurial ecosystem is not enough if existing levels of inequality in the labor market persist, a problem that translates into marginalization and vulnerability for women, especially in economic sectors with high male-dominated ratios.

Based on the above, it is expected that the selected methodological process will offer results that explain the current conditions of the genre in terms of financing for entrepreneurial activities. Two hypothetical scenarios are supported:

Null Hypothesis: There are no differences in the mean ranges between the gender groups.

Alternative Hypothesis: There are differences in the mean ranges between the gender groups.

With the previously proposed coding to identify men and women to enter the data into SPSS, whose motive is to achieve the valuation of the Mann-Whitney U test, resulting in a high significance of the variables in the study by presenting a p-value of 0.018, consequently, the null hypothesis is rejected, as its p-value is less than 0.05. In this sense, it is evident that the average ranges of men and women differ when obtaining the seed capital granted by MSMEA (see Table 1).

An outstanding element is undoubtedly that women outnumber men, monopolizing 62% of the grants (7,644 of 12,330 beneficiaries), while men represent 38%, quantifying their grants at 4,686 (see table 1). This gap is in line with a study in Panama by Alegra.com, which already maintains that by 2022, women were 58.6% entrepreneurs (Barrantes, 2022).

This evolution in the advancement of the female collective is compatible with a global report presented by the Global Entrepreneurship Monitor (GEM), which highlights a 10.4% increase in the creation of companies by women, compared to the 6.1% estimated at the beginning of the 2000s (Armani, 2025).

Table 1. *Nonparametric Mann-Whitney U test*

Ranks

	Gender	N	Mean Rank	Sum of Ranks
SEED CAPITAL	1-Men	4,686	6,237.27	29227847.00
	2-Women	7,644	6,121.50	46792768.00
	Total	12,330		

Test Statistics[a]

	SEED CAPITAL
Mann-Whitney U	17573578.000
Wilcoxon W	46792768.000
Z	-2.360
Asymp. Sig. (2-tailed)	.018

a. Grouping Variable: Género

Source: Prepared based on SPSS results.

When analyzing the first report, which contains 19observations out of the 67 generated by the crosstabs in which men and women obtained seed capital to undertake, reference is made first to the most notable frequencies of the female collective (see Table 2), that is, the weight of the amounts awarded in the entrepreneurial proposal are given by 70.19% in ranges of $.1,000, accounting for $.813,000 out of a total of $.1,158,360; then there are those awarded in the range of $.900 representing 8.16% ($. 94,500 $. 1,158,360); thirdly, those who obtained $.950 and whose weight reached 6.64% ($. 76,950 of $. 1,158,360).

A total of 1,239 women enrolled in the program obtained seed capital funding in this first segment of the analysis, reflecting a high Spearman correlation of 0.900 in the frequency distribution, with statistical significance as its p-value was less than 0.001 Financing for female entrepreneurship is highly relevant in Panama, being the fourth in the world according to Hill *et al.*, (2025). However, the same report indicates that 8% of women stop operating their businesses due to lack of money. This consequently leads to generating initiatives or policies from the private sector such as that of BBVA, which shows that 65% of the microfinance program clients are women, highlighting that out of every 10, 7 escape poverty through entrepreneurship (RP, 2025).

This non-reimbursable financing granted to this segment, namely $1,158,360 in the case of women, is relatively located at 62.81% of the total quantified at $1,844,275 observed in Table 4; being the province of Panama in terms of range of greatest weight by frequency of beneficiaries, that is, $1000 with 23.91% (324 beneficiaries), followed by the province or region of Chiriquí contributing 15.94% (216 beneficiaries) and the third most important with 176 beneficiaries, the region or province of Bocas del Toro representing 12.99% (Valverde-Batista, 2025).

For its part, the male group obtained seed capital in the amount of this first segment in the order of $. 685,915 (see table 2), which is the same as 37.19% of the total ($. 1,844,275). Of the amount previously described, the most important ranges are $. 1,000 with 79.02% ($. $542,000 of $. 685,915), having a similar behavior with the female group, having in the second and third ranges $ 900 ($. 55,800 of $. 685,000) and $. 950 ($. 34,200 of $. 685,915), with 8.14% and 4.99% respectively (see table 2).

This association of the variables studied according to the data extracted with the cross-tab method and considering the first segment, allows a Spearman correlation of 0.995, perhaps explained by a greater concentration in seed capital with those three ranges, namely, 92.15% unlike the female group which was 84.99%, showing the male group a greater effectiveness in presenting their respective applications in the call.

Table 2. *Frequency of beneficiaries and seed capital obtained by gender*

No.	Seed Capital	Frequency and amount of seed capital for the female collective		Frequency and amount of seed capital from the male collective	
1	0	3	0.00	0	0.00
2	400	2	800.00	0	0.00
3	500	13	6,500.00	4	2,000.00
4	600	13	7,800.00	5	3,000.00
5	650	1	650.00	0	0.00
6	700	100	70,000.00	7	4,900.00
7	750	24	18,000.00	12	9,000.00
8	800	40	32,000.00	20	16,000.00
9	820	2	1,640.00	0	0.00
10	850	35	29,750.00	18	15,300.00
11	870	0	0.00	1	870.00
12	890	1	890.00	1	890.00
13	900	105	94,500.00	62	55,800.00
14	950	81	76,950.00	36	34,200.00
15	970	1	970.00	0	0.00
16	975	1	975.00	1	975.00
17	980	3	2,940.00	1	980.00
18	995	1	995.00	0	0.00
19	1,000	813	813,000.00	542	542,000.00
Total		**1,239**	**1,158,360.00**	**710**	**685,915.00**

Source: Prepared based on SPSS results.

When analyzing the second segment consisting of 19 observations, from the seed capital range whose denomination goes from $. 1,100 to 1,950, the female group received $. 948,200.22 (see table 3), that is, 63.20% of the total, in other words, as part of the $. 1,500,272.60 observed in table 4. Within this set of seed capital in this group, the range of $. 1,800 stands out with 45.56% of the total amount when multiplied by the 240 beneficiaries who obtained this range ($. 432,000 of $. 948,220.22), after this is the range of $. 1,500; having a beneficiary frequency of 96, they make a product quantified in $.144,000 representing 15.19% and in third position despite having a lower frequency of beneficiaries with 43, the range of $.1,950 generating an amount of $.83,850 reaching a percentage participation of 8.84%.

Table 3. *Frequency of beneficiaries and seed capital obtained by gender*

No.	Seed Capital	Frequency and amount of seed capital for the female collective		Frequency and amount of seed capital from the male collective	
1	1,100	59	64,900.00	7	7,700.00
2	1,150	0	0.00	1	1,150.00
3	1,200	57	68,400.00	53	63,600.00
4	1,300	28	36,400.00	12	15,600.00
5	1,400	1	1,400.00	1	1,400.00
6	1,472.23	1	1,472.23	0	0.00
7	1,500	96	144,000.00	54	81,000.00
8	1,600	2	3,200.00	5	8,000.00
9	1,700	13	22,100.00	3	5,100.00
10	1,799	1	1,799.21	0	0.00
11	1,800	240	432,000.00	143	257,400.00
12	1,850	13	24,050.00	8	14,800.00
13	1,880	1	1,880.00	0	0.00

14	1,885	0	0.00	1	1,885.00
15	1,900	31	58,900.00	22	41,800.00
16	1,900.66	1	1,900.66	0	0.00
17	1,937.38	0	0.00	1	1,937.38
18	1,948.12	1	1,948.12	0	0.00
19	1,950.00	43	83,850.00	26	50,700.00
Total		**588**	**948,220.22**	**337**	**552,072.38**

Source: Prepared based on SPSS results.

This second segment analyzed for the female group yields a high Spearman correlation of 0.977, a significant level of associativity given its p-value of <0.001. This value is well above that obtained for the first segment, although the concentration of the three main ranges, i.e., 69.56%, is lower than that observed for the first segment, 84.99%, explained by the more pronounced distribution in the first ranges of the 19 observations.

When evaluating the male group in the second segment, the change in the association of the variables is almost imperceptible with respect to the first segment, with Spearman's correlation coefficient of 0.994, enjoying high statistical significance with a p less than 0.001; anifesting when observing in table 3 that its distribution is such that its frequencies are polarized in the three extremes of the sample, that is, in the central one with the frequencies of 143 beneficiaries in the range of $. 1,800 of seed capital, producing a total amount of $. 257,400, while at the final extreme with the range of $. 1,950 with a frequency of 26, the product comes to represent 9.18% ($. 50,700 of $. 552,072.38) and, finally, at the initial end two frequencies of 54 and 53, linked with seed capital of 1,500 and 1,200 respectively.

The financing granted in this segment of seed capital to the male group represents 36.80%, namely, of the amount of $.552,072.38 observed in Table 3, as part of the $.1,500,272.60, total amount of government support by MSMEA (see Table 4). From such funds a regional distribution of beneficiaries emerges, showing in the results of a previous study that the province or region of Panama concentrates 69.19% of the main range in which both female and male groups obtained seed capital, that is, the range of $1,800 (265 beneficiaries out of 383); followed by the beneficiaries of the regional or province of Chiriquí with 48, being 12.53% of the total and third appears the province or region of Colón with 21 beneficiaries, in other words, relative to 5.48% (Valverde-Batista, 2025).

In the third segment, the total amount of seed capital for said segment of the female group is $19,842.02, representing 49.9% slightly lower than that of the male group ($19,842.02 of $39,735.11), with the fact that, of the 10 beneficiaries, 70% belong to the province or region of Colón being highly relevant (Valverde-Batista, 2025).

Table 4. *Beneficiaries and seed capital obtained according to gender of each segment evaluated*

No.	Frequency and amount of seed capital for the female collective		Frequency and amount of seed capital from the male collective		Total, beneficiaries and seed capital	
1	1,239	1,158,360.00	710	685,915.00	1,949	1,844,275.00
2	588	948,200.22	337	552,072.38	925	1,500,272.60
3	10	19,842.02	10	19,893.09	20	39,735.11
4	5,807	11,613,997.02	3,629	7,257,999.24	9,436	18,871,996.26
Total	**7,644**	**13,740,399.26**	**4,686**	**8,515,879.71**	**12,330**	**22,256,278.97**

Source: Prepared based on SPSS results.

In the case of the male group, the analysis of the third segment leads to referring to a similar associative behavior of the variables as the female group, that is, a Spearman coefficient of 0.916 when counting with the same number of frequencies in the beneficiaries (10 in total), with a total valuation of seed capital of $. 19,893.09 (see Table 4); differentiating only in the localities where the funds were given, knowing that 60% were granted in the regional or province of Veraguas (Valverde-Batista, 2025).

When assessing the last segment that includes 10 observations from the MSMEA seed capital program data, in reference to the female group, it confirms the gap with the male group, receiving $11,613,997.02 (see table 5); and that in relative terms would be 61.54%, when divided by the total segment quantified at $18,871,996.26 observed in table 4. The range and final objective of the beneficiaries when requesting seed capital was $2,000, with a frequency of 5,799 beneficiaries out of 9,426 when adding the 3,627 from the male group (see table 5), representing 61.52% of them; sufficient to achieve a high Spearman correlation of 0.887 with high statistical significance at $p<0.001$.

Table 5. *Frequency of beneficiaries and seed capital obtained by gender*

No.	Seed Capital	Frequency and amount of seed capital for the female collective		Frequency and amount of seed capital from the male collective	
1	1,999.25	0	0.00	1	1,999.25
2	1,999.50	2	3,999.00	0	0.00
3	1,999.54	1	1,999.54	0	0.00
4	1,999.56	1	1,999.56	0	0.00
5	1,999.62	1	1,999.62	0	0.00
6	1,999.70	1	1,999.70	0	0.00
7	1,999.77	1	1,999.77	0	0.00
8	1,999.83	1	1,999.83	0	0.00
9	1,999.99	0	0.00	1	1,999.99
10	2,000.00	5,799	11,598,000.00	3,627	7,254,000.00
Total		**5,807**	**11,613,997.02**	**3,629**	**7,257,999.24**

Source: Prepared based on SPSS results.

At the territorial level, this rank was achieved by 30.74% of beneficiaries in the province of Panama (2,898 out of 9,426); the recent province or region of Panama Oeste contributed 1,106 beneficiaries, representing 11.73%; and the province or region of Veraguas finishes in the top three with 10.36% (Valverde-Batista, 2025). For its part, the male group has a percentage participation of 38.46% of the funds granted ($. 7,257,999.24 observed in table 5 of $. 18, 871,996.26 observed in table 4, evidencing that women have a better disposition to undertake, although the Spearman correlation in the case of the male group has greater power by reaching a coefficient of 0.995, probably due to the concentration of the beneficiaries of the seed capital range of $. 2,000 with the 99.94% observed in table 5 ($. 7,254,000 of $. 7,257,999.24).

Analyzing gender issues involves finding a gender gap that tilts against women. In this case, it is gratifying to find that women outnumber men when it comes to starting a business in Panama. It is symptomatic that the results promote the idea that the MSMEA seed capital program (2021), in terms of gender, leans pleasantly towards women, indicating already by 2021 that more than 60% had been granted to them.

Conclusions

At the end of the study and focusing on the entrepreneurial ecosystem promoted by the government organization, we can conclude with:

The gender gap in seed capital funding favors women, highlighting that women have a stronger and more entrepreneurial attitude in Panama, in line with the results already reported by international organizations that measure these indicators worldwide.

The level or class with the highest allocation by beneficiaries was $2,000, the total amount of which represented 84.70%, when multiplied with a frequency of 9,426 (5,799 women and 3,627 men), followed by seed capital of $1,000 with 6.09% when multiplied with a beneficiary frequency of 1,355 (813 women and 542 men); the third seed capital and closing the podium were those awarded $1,800 with 3.10%, when multiplied by a beneficiary frequency of 383, i.e., 240 women and 143 men.

The results of the third segment (of the capital granted from 1,953.52 to 1998.86) of the sample favor the male group, although relative to their weight in the total, they are too small to influence the overall sample.

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Rights and guarantees for the protection of internally displaced persons

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Introduction

In a globalised world where social dynamics between individuals and nations prevail, they develop a series of activities that establish parameters for growth and development within an economic margin that allows for permanence, stability or economic crisis, which directly affects people in the world of work and professional life, with an impact on society.

This situation is exacerbated when, within the country or nation itself, human mobility occurs (Silva, 2020). One variant of human mobility is internal displacement, which is caused by different factors or conditions such as economic, environmental, natural disasters, war, guerrilla warfare, and megaprojects (infrastructure construction or extractive projects). All of these involve various actors within the country or nation itself, such as the state, communities, citizens, businesses, organised crime, among others.

Therefore, it is imperative to socialise and disseminate the guiding principles of internal displacement in a systematic manner and in language that is close to everyday life. Internally displaced persons acquire the condition/situation of uprootedness derived from multiple factors; it is an involuntary or compulsory action that lacks personal decision-making (United Nations, 1978). As a result, their fundamental and human rights are sometimes violated or infringed upon in an institutionalised manner by the state, which is responsible for guaranteeing and imparting justice. It is therefore important to analyse the scope and guarantee of the rights of affected internally displaced persons.

The Global Report on Internal Displacement (IDMC, 2024, p. 3) states that

> at the end of 2023, 75.9 million people were living in a situation of internal displacement worldwide, compared to 71.1 million in 2022. It states that displacement due to conflict continued to increase because '68.3 million people were internally displaced as a result of conflict and violence at the end of 2023, the highest figure since records began. Sudan, Syria, the Democratic Republic of Congo (DRC), Colombia and Yemen are home to almost half of the world's internally displaced persons.

Natural disasters have changed displacement patterns. At the end of 2023, 7.7 million people were internally displaced worldwide as a result of disasters. This calls for a rethinking of public policy strategies and actions. Based on data from the Global Report (IDMC, 2024), disasters caused 26.4 million new internal displacements, or movements, in 148 countries and territories during 2023, making it the third highest figure in the last decade.

Finally, the number of people living in situations of internal displacement has more than doubled since 2018, reaching a record 83.4 million in 117 countries and territories by the end of 2024 (IDMC, 2025). The legal analysis of internal displacement is crucial because it helps to identify and protect the rights of displaced persons, as well as to ensure lasting solutions to their situation. It allows for the establishment of legal frameworks that prevent displacement, assist people during displacement and facilitate their return or resettlement.

Which ones? For what purpose? The Guiding Principles on Internal Displacement

According to the United Nations (1998), within the framework of promoting and fostering human rights and fundamental freedoms in relation to mass exoduses and displaced persons, guiding principles for internal displacement have been established. These principles, which aim to protect people in such vulnerable situations (Feito, 2007), are governed by international, regional and national law, and their dissemination and applicability should be expanded through administrative and judicial bodies.

To this end, internally displaced persons should be understood as:

> Persons or groups of persons who have been forced or compelled to escape or flee from their home or place of habitual residence, particularly as a result of or to avoid the effects of armed conflict, situations of generalised violence, human rights violations, or natural or man-made disasters, and who have not crossed an internationally recognised state border. (United Nations, 1998, p. 5)

These principles are not laws, but they offer guidance to governments and other entities on how to prevent and respond to displacement, as well as guarantee protection and assistance to displaced persons. To this end, we must consider the following key principles:

- Prohibition of arbitrary displacement. Under a humanitarian assistance and human rights framework, people should not be displaced, especially when there are viable alternatives, and the integrity and well-being of the individual and their family should never be compromised.
- Compensation and reparation. In the event of loss of assets and/or property, individuals are entitled to fair compensation.
- Return, resettlement or local integration. They have the right to return to their homes provided that security conditions exist, as well as to be settled in new communities.
- Protection and assistance. The authorities have an obligation to guarantee the right to basic humanitarian assistance.
- Legitimacy of civil, political, economic, social, and cultural rights. Being displaced does not exempt them from these rights.

In this regard, the importance of these principles enshrines the international regulatory framework, the protection of human rights (Barahona *et al.*, 2024), and the prevention and response to displacement.

Rights and guarantees

Displacement involves identifying rights that violate the dignity and integrity of the person (Oehler, 2022), such as the right to life; the right to dignity; the right to physical, mental, or moral integrity; the right to liberty and personal security; the right to move freely within and outside settlements; the right to seek safety in another part of the country; the right to seek asylum; the right to know the fate and whereabouts of missing family members; the right to respect for family life; the right to an adequate standard of living; the right to basic food supplies; the right to recognition as a person before the law; the right to freedom of thought, opinion and expression; the right to seek employment and participate in economic activities; the right to freedom of association; the right to vote and participate in public and governmental affairs; the right to communicate in a language they understand; the right to education.

These rights reflect and do not contradict international human rights law and international humanitarian law. They reaffirm the rules applicable to internally displaced persons, which are widely scattered across existing instruments, clarify any ambiguities that may exist, and seek to fill the gaps identified in the

compilation and analysis. These rights grant protection against arbitrary displacement, provide access to protection and assistance during displacement, and guarantee protection during return or alternative settlement and reintegration. Legal analysis of internal displacement is crucial because it helps to identify and protect the rights of displaced persons, as well as to ensure lasting solutions to their situation. It allows for the establishment of legal frameworks that prevent displacement, assist people during displacement, and facilitate their return or resettlement.

Aspects such as the protection of rights involve considering the prevention and attention to the vulnerability of civil, political (United Nations, 1966a), economic, social and cultural rights (United Nations, 1966b), which must guarantee and ensure that displaced persons have access to protection and assistance. The responsibility of the State includes providing assistance and protection during displacement, providing minimum humanitarian assistance and access to basic essential services, as well as reviewing, creating and modifying the legal framework and policies that effectively address displacement, combined with access to justice, whereby displaced persons can report violations of their rights and, where appropriate, obtain reparation for the harm suffered. Recognition of legal personality means that the person obtains identity documents and other documents required to exercise their rights. It is therefore the responsibility of the State to guarantee the full exercise and protection of the rights of displaced persons within its borders. The rights and guarantees of displaced persons must be mechanisms that ensure the effective exercise of their rights. These rights are inherent to individuals, and guarantees are the instruments or mechanisms that protect those rights (Ovalle, 2016). In this regard, there is an international framework that establishes non-discrimination, protection against arbitrary displacement, humanitarian assistance, and other rights mentioned above. The effective application of these rights and guarantees is essential to ensure that displaced persons can rebuild their lives and enjoy a dignified and secure life. The protection of the rights of displaced persons is a shared responsibility of States, international organisations and civil society.

The rights of internally displaced persons entail that the rule of law assumes responsibilities in relation to the situation regarding the obligations arising from the protection of displaced persons, which can be seen in three aspects (SCJN, 2024). The first aspect is relocation (from a preventive perspective), the second is relocation (ensuring the dignity of the person), and the third is what happens after relocation (which involves resettlement or return to the place of origin). It should be emphasised that people involved in displacement have a multilateral impact, i.e., they acquire a condition of vulnerability and defencelessness that must be identified from a legal perspective, as well as the aspect of vulnerable groups involved in this context.

It is understood that, in terms of the rights and guarantees of displaced persons, their condition must be considered from both a personal and collective perspective (Salazar, 2014; Pérez & Ortega, 2020), with the right to a dignified life, protection against violence, humanitarian assistance, respect for culture and traditions, protection of identity, access to justice, access to basic services, the right to family reunification (Lucho & Ayala, 2021), protection against violence and non-discrimination. In addition to this, reparation for damage caused by the violation or vulnerability of their rights must be considered. As a State, a budget must be integrated, due to the increase in actions carried out under internal displacement. It is necessary to work on public policies that contribute to a diagnosis and analysis of the causes; characterisation of the population in that context; evaluation of resources; design or restructuring of the regulatory and legal framework, in accordance with the conditions and needs of the entity; implementation and follow-up must be considered, including the assignment of responsibilities, training, and monitoring and evaluation; all of the above must be done from a local, regional, national, and international perspective that respects human dignity, offering transparency, access to information, and open data for study, understanding, and addressing the current reality. Although the State has official and institutional records on human mobility, a registration system should be established (González, 2018) specifically for internally displaced persons, allowing for the uniqueness and particularities of each case or situation that gives rise to displacement. The issue must

be centralised, i.e., it must be present on the public agenda of the government administration in power. Ensure or establish mechanisms for prompt return or relocation and reparation of damage; that is, ensure that optimal conditions exist for the integrity of the person. All of the above amounts to good public policy (Mestries, 2018) in which there is horizontal alignment of its integration and execution.

Conclusions

The rights of internally displaced persons must be guaranteed, and the extent of their vulnerability must also be considered. The State, in collaboration with civil society and other organisations, has a responsibility to strengthen resilience mechanisms and invest in local, regional and national capacities that will enable infrastructure and adaptation to new ways of life that are relevant and sustainable in the short, medium and long term. The State must integrate bodies with professional staff trained in displacement issues, who must also be familiar with and apply the administration and system of access to justice, which entails the obligation to respect, protect, prevent and comply (Terreros, 2020), since, as already mentioned, this situation of displacement can occur for various reasons, such as environmental factors, natural disasters, organised crime, among others.

A comprehensive approach must be developed that addresses the causes, consequences, scope, and impact of internal displacement, prioritising the rights of people in vulnerable situations and promoting lasting solutions that enable them to rebuild their lives and reintegrate into society from a social, cultural, and economic perspective.

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Using Augmented and Virtual Reality as Strategies for Inclusive Education at the University Level: A Systematic Review S

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Introduction

In recent decades, education has undergone significant transformations aimed at ensuring the right of all individuals to equitable and quality learning. One of the most relevant changes has been the incorporation of the inclusive education approach, understood as a model that seeks to guarantee access, retention, and academic success for all students, regardless of their personal, social, or cultural characteristics. Despite normative and pedagogical advances, various forms of exclusion still persist in educational settings, stemming from economic conditions, disabilities, ethnic background, migratory status, language, religion, gender, or sexual orientation (Ayala *et al.*, 2022). In response to these challenges, the need to rethink traditional methodologies has been acknowledged, incorporating innovative tools that support diversity.

In this context, the use of emerging technologies such as Virtual Reality (VR) and Augmented Reality (AR) has gained importance as a means to enrich teaching and learning processes and foster inclusion. These technologies enable the creation of immersive, interactive, and multisensory experiences that not only facilitate the understanding of complex content but also enhance motivation, creativity, and personalized learning (López, 2024). From this perspective, the present study aims to analyse the use of Virtual Reality and Augmented Reality as support tools to promote inclusive education at the university level, exploring their potential to address the needs of students with diverse conditions and learning styles. This research seeks to contribute to the development of innovative pedagogical proposals that strengthen equity and inclusion in higher education.

Research Problem

Inclusive education has become a fundamental pillar for ensuring the right to education at all levels. However, within the university context, significant challenges remain in achieving the effective inclusion of students with diverse conditions, abilities, and sociocultural backgrounds. At the same time, the development of immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) has opened new pedagogical possibilities that promote accessibility, active participation, and personalized learning. Although there are documented experiences and research on the implementation of AR and VR tools in educational settings, the available information remains fragmented and lacks the systematization necessary to fully understand their impact on inclusive higher education. In this context, the present systematic review aims to identify, analyse, and synthesize the existing scientific evidence on the use of AR and VR as support strategies to foster inclusive processes in higher education.

Based on this premise, the following research question is posed: What scientific evidence supports the use of Augmented Reality (AR) and Virtual Reality (VR) tools as support for inclusive education at the university level? To address this question, the general objective is defined as: to systematically analyse the scientific evidence on the use of AR and VR tools as support strategies in inclusive education processes in higher education. In addition, the following hypothesis is proposed: There is scientific evidence supporting the use of Augmented Reality (AR) and Virtual Reality (VR) tools as effective strategies for promoting inclusive education in higher education.

Theoretical Framework

According to Cárdenas *et al.* (2024), a research project was carried out using Augmented Reality (AR) with the aim of enhancing the learning experience of students enrolled in the Information Technologies program at a technological university. The results showed that the developed applications were functional and well-received by the students. In terms of usability, 85% of participants considered the applications easy to use. Regarding motivation, 90% reported increased interest and engagement during classes. Additionally, 75% indicated that these tools were useful as educational complements, helping to facilitate the understanding of complex concepts. The study concluded that interacting with three-dimensional models through AR supports the assimilation of abstract content and significantly improves the learning experience.

In this same vein, Zaragoza and Cuevas (2020) developed a mobile application for the Computer Workshop course in order to integrate a common tool among young people —the cell phone— into an attractive and innovative educational environment. The application was designed based on the course syllabus, focusing on devices and components representative of microcomputers. For the three-dimensional modelling of the elements, the software Maya and SketchUp were used, developing a total of 14 key components. As a result, it was concluded that Augmented Reality, as an educational resource, represents significant support in the teaching–learning process, especially by promoting the design of innovative content in the Computer Workshop course.

Martínez (2024) emphasizes that AR and VR make it possible to represent abstract content in a visual and interactive way, which facilitates understanding and improves academic performance, especially in students with specific educational needs.

Finally, a literature review by Sánchez & Torres (2021) reported on a study conducted with Industrial Engineering students, in which an AR application was implemented to support the understanding of industrial process diagrams. The results showed that 88% of participants reported a better understanding of the content when viewing processes in 3D, and 82% stated that the tool increased their motivation toward the subject. The authors concluded that AR helps overcome abstract barriers in technical knowledge, particularly benefiting students with visual and kinaesthetic learning styles.

As part of the review process, Table 1 presents the main findings of the first seven selected articles. It specifies the technology used in each study and highlights that all investigations focus on higher education, in accordance with the established inclusion criteria.

Table 1. *Classification of Articles by Technology Used*

N°	Author (Year)	Technology Used	Educational Level	Type of SEN Addressed	Main Findings
1	Ortí Martínez (2024)	AR y VR	University	Learning Difficulties	Improvement in Mathematical Comprehension through Immersive Visualization
2	Rodríguez Cano *et al.* (2023)	AR and VR (App FORDYSVAR)	University	Dyslexia	Improved accessibility and motivation
3	Romero-Esquinas *et al.* (2024)	VR	University	Functional diversity	Adaptive environments with Universal Design for Learning
4	Prieto Andreu (2025)	AR, VR, MR	University	General / Collaborative	Stimulates collaborative inclusive learning
5	Alonso Muñiz *et al.* (2024)	AR and VR	University	Not specified (overview)	Accessible AR, more immersive VR
6	Marín Díaz (2018)	AR	University	diverse SEN	Effective and motivating adaptations
7	Dudley *et al.* (2023)	VR, Metaverse	University	General accessibility	Need to standardize accessibility in immersive environments
8	Rivera Torres & Pérez Gómez (2023)	AR	University	Autism spectrum disorder	Improvement in interaction and autonomy

N°	Author (Year)	Technology Used	Educational Level	Type of SEN Addressed	Main Findings
9	Londoño Cardona (2022)	VR	University	Physical and sensory disability	Greater retention and access to content
10	Ramírez León *et al.* (2023)	AR and VR	University	SEN in science	Facilitates understanding and inclusive participation

Table 2 presents a summary of key criteria considered for the inclusion of the 20 articles selected in this systematic review. In this table, it can be observed that more than 60% of the analyzed studies explicitly address the topic of educational inclusion.

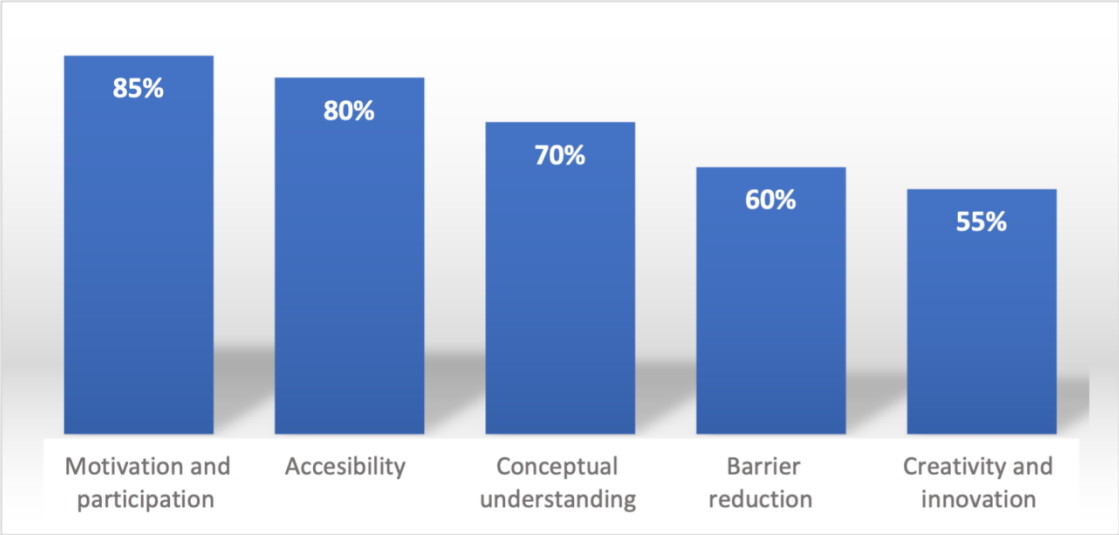
Table 2. *Classification of the Criteria Found in the Studies*

Category	Common Observations
Predominant use	VR for immersive simulations; AR for interactive content visualization.
Educational level	Higher education, especially in technical, medical and technological careers.
Educational inclusion	Present in more than 60% of studies, either explicitly or transversally.
Featured benefits	Improved motivation, conceptual understanding, active learning, and accessibility.
Common limitations	Cost, need for teacher training, and little methodological standardization.

Figure 1 shows that 85% of the studies report an improvement in student motivation and participation, while 80% highlight accessibility as one of the main benefits. These results suggest that the use of Augmented Reality (AR) and Virtual Reality (VR) not only provides technical advantages but also significantly contributes to strengthening emotional and social aspects in the learning process.

The reviewed studies agree that both Augmented Reality (AR) and Virtual Reality (VR) are technological tools with high potential to support inclusive education at the university level. Based on the analysis of the 20 selected articles, the following key findings were identified.

Figure 1. Improvements in the use of AR and VR



Five studies indicate that AR and VR facilitate the representation of abstract or complex concepts, which is particularly beneficial for students with learning difficulties or special educational needs.

Four studies specifically address the inclusion of students with conditions such as dyslexia, autism, and hearing or visual impairments, showing improvements in both access to content and active participation in the educational environment.

Finally, two studies emphasize the importance of involving end users in the design process of technological tools, which contributes to ensuring greater accessibility and better adaptation to their specific needs

Conclusions

The reviewed studies show that Augmented Reality (AR) and Virtual Reality (VR) offer significant advantages for the representation of abstract content, facilitating its understanding—especially among students with specific educational needs. These technologies are emerging as effective pedagogical tools for promoting more accessible, personalized, and inclusive educational environments in higher education. The immersive experiences provided by AR and VR have the potential to eliminate physical, sensory, and communicative barriers by facilitating collaborative learning in adaptive virtual environments. These features allow students with diverse personal conditions to work together, overcoming limitations that would otherwise be exclusionary in traditional settings.

However, important challenges remain for their widespread implementation. These include the need for adequate technological infrastructure, specific teacher training, availability of accessible resources, and effective curricular integration. Additionally, some AR and VR applications still present technical limitations for individuals with severe disabilities, highlighting the urgency of developing more inclusive solutions from the design stage. Although the current findings are promising, it is necessary to expand the empirical base through longitudinal and experimental studies that evaluate the actual impact of these technologies on inclusive education over time and across different disciplines. Only then will it be possible to consolidate their effectiveness and sustainability in diverse educational contexts.

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Normative and social convergence in the post-fire of Valparaíso, Chile. An experience of anthropic resilience for vulnerable habitation

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This text is part of the course "Applied Research" of the Architecture course of the Universidad del Desarrollo, Santiago, Chile.

Introduction

Valparaíso has been recurrently affected by fires throughout its history. Fire is a type of catastrophe that has not been institutionalized in the world's regulations in the same way that earthquakes or tsunamis have been. This is due, first, to the complexity of the catastrophe, which cannot be predicted how it will affect each place, and second, to the difficulty of regulating the way of building. On the other hand, the case of Valparaíso has all its ravines inhabited, where there are families who have lived there all their lives, and who have an established culture and way of living, so moving them is not a viable option.

It is hypothesized that social and sociological variables directly influence disaster resilience, these variables being of greater importance than building and infrastructure conditions.

Chile, as one of the countries with more catastrophes in the world, has a construction tradition with buildings that respond well to catastrophes. However, there is also an inequality that distinguishes the country. This inequality also generates vulnerable habitats in risk areas, where it is not allowed to settle and which exposes people of scarce resources by locating themselves illegally.

Unrestricted reconstruction

A risk zone is defined by two aspects: vulnerability and hazard. Vulnerability is the condition of people and assets exposed to a hazard, which, due to their degree of information and training or due to their quantity, location, material conformation, functional disposition, etc., have a certain degree of capacity or inability to face or withstand the action of the possible event (United Nations DRR, 1989; UNISDR, 2021).

This means that vulnerability is given by the person who is affected. Hazard, on the other hand, is the latent danger represented for a site by the possible occurrence of a catastrophic event of natural or technological origin in a determined period of time (United Nations DRR, 1989; UNISDR, 2021). Considering that a hazard is unpredictable and unavoidable, the edge to prevent should be people, i.e., their vulnerability and their capacity to build resilient communities.

Fires are a very recurrent catastrophe in the history of Valparaíso. From its origins it was known as *aliamapa* (aliamapu), which means scorched land (Espinosa, 2013). In addition, there is an extensive record of its fires throughout history. But one of the big problems is that the occurrence of fires is not considered in the categorization of risk areas according to the Ministry of Housing and Urbanism, so there are very few regulations in this area. This generates concerns about the regulation methodology in the re-construction of places affected by fires, as is the case of Valparaíso

After the 2014 fire, 3,230 dwellings were surveyed, of which 2,491 dwellings had irreparable damage, 165 had minor damage and 582 were undamaged. Therefore, there is a number of 2,656 homes that were rendered unfit for use post-fire (MINVU, 2019). This leads to many people having to be evacuated from their homes who, without an answer, tend to rebuild their homes in the same place where they

lived before. According to David Gouverneur (2016), professor at the Department of Landscape Architecture and Regional Planning at the University of Pennsylvania in Philadelphia, it is due to a problem of repopulation and reconstruction, where the only way to avoid the problem of risk areas is by equipping that area, that is, by inserting some type of program that improves the quality of life of the neighbors, in addition to avoiding the reconstruction of homes that are affected by possible subsequent disasters.

Of the homes affected in Valparaíso, only 43% were in safe areas, which revalidates the idea that there is poor regulation and a large number of homes in risk areas. In addition to the fact that 53% of the reconstructed houses are classified as precarious (Observatorio Valparaíso, 2015). It is necessary, then, to work on a more sensitive and smaller scale on the real problem of the communities that inhabit the ravines, making fair and necessary interventions so that they do not change the culture or the way of living, but improve their quality of life and resilience in the face of catastrophes.

Anthropic risk

From the point of view of the natural sciences, risk is considered as a function of the probability of an event and the magnitude of its possible damage. From this objectivist perspective, risk analysis aims at quantification and valuation. In the social sciences, on the other hand, a constructivist perspective of risk predominates, which focuses, in a qualitative manner, on the influence of the perceptions and decisions of the actors on the social construction of risk (Coy, 2010, p. 10).

This implies that not only natural or infrastructural factors influence the decisions taken at the time of proposing a resilient intervention. There is a social or sociological issue that has a direct impact on the people living in a place affected or likely to be affected by a disaster. From an expert's perspective, the anthropogenic aspect, i.e., the person, should not be left aside.

Ministry of Housing and Urban Development (MINVU), through Galaz & Corvalán (2016), expresses that there are four types of concepts at the time of catastrophes: Threat, is understood as the natural or anthropic phenomenon that may or may not become a destructive event; Destructive Event, is the manifestation of a threat on an exposed population, which may or may not be considered as a disaster; Disaster, is understood as the devastating consequence of natural or anthropic phenomena that manifests itself on a population; Risk, is the probability that a system suffers damage.

According to the ideas presented by the United Nations and Martin Coy, adding the vision of MINVU, it is possible to conclude that what makes a destructive event a catastrophe is the exposure and risk of the human being.

The case of Cerro La Cruz

In order to determine the case to be investigated, that is, which hill or hills, the number of neighborhood councils that exist in each hill of the city was observed as a key factor. This becomes relevant when studying urban regeneration experiences such as Medellín, where citizen participation is a key act in the development of projects. Therefore, by understanding the number of inhabitants and the number of neighborhood councils, it is determined that La Cruz hill would be the hill that could most easily involve neighbors in the management of a project. By averaging the number of inhabitants of the hill divided by the number of neighborhood councils, it can be concluded that the hill with the most neighborhood councils per inhabitant is Cerro La Cruz.

In addition to the economic cadaster, the municipality of Valparaíso makes a cadaster of the damage to each home and separates them according to their location or hill. Understanding and analyzing each of these data, it is concluded that La Cruz hill is one of the most affected in terms of damage with a total of 834 irreparable houses (Campos, 2016).

The dilemma of urban regulations

The four main points that the General Ordinance of Urbanism and Construction in Chile (OGUC) proposes in its article 4.3.1 are: That the rescue of building occupants in case of fire be facilitated; That the risk of fire be reduced to a minimum, in each building; That the spread of fire be prevented, both to the rest of the building and from one building to another; That the extinguishing of fires be facilitated.

OGUC also states that there are two types of fire protection: Passive Protection, which is based on construction elements that by their physical conditions isolate the structure of a building from the effects of fire for a certain period of time, and Active Protection, which is composed of systems that, connected to sensors or detection devices, automatically come into operation in the face of certain ranges of particles and air temperature.

There is a lack of regulations at the urban level. Thinking specifically in the case of Valparaíso, given the geographic conditions of the place and the type of existing constructions, the regulations that regulate fires are not enough to avoid catastrophes or to reduce the number of victims on a large scale due to the particular and singular nature of the regulations.

Some of the solutions proposed in the ordinance have been implemented on La Cruz hill, such as evacuation routes or connected systems for use by firefighters. But these appear in the lower part of the hill, where the houses have better infrastructure, where it is easier to evacuate. However, the informal dwellings that are farther away from everything and with worse infrastructure do not have accessible evacuation routes or systems for firefighters. Despite this, the needs of a population like the one at the end of El Vergel Street are not only these, but also neighborhood-level equipment (Figure 2).

Fire resilient communities

A study conducted by the journal BioScience (Smith *et.al.*, 2016) proposes two ways of dealing with large-scale fires, with different strategies for each. It requires forming a culture of risk assessment, which considers: Reducing household susceptibility to wildfire losses; Increasing resilience of homes and communities to spread; Reducing development in fire-prone areas.

In turn, a resilient and evacuation culture requires fire-adapted communities that effectively live with fire, new industries designing fire-adapted environments and building materials, and fire education in a culture of sustainable environments.

International programs seek to solve in a social way, educating, informing and instructing people to make communities more resilient to this type of catastrophes, which are not yet fulfilled in Chile.

Based on five steps to follow which, taking them to the Valparaíso situation, are completely applicable and valid. These include Conduct a risk assessment; Organize a committee and create an action plan based on the previous assessment; Conduct a fire awareness day; Invest a minimum of US$ 2 per capita per year in actions for the organization; and appoint an authority, a response coordinator, at the state level.

Fire as an opportunity

The houses of Cerro La Cruz were totally affected by the fire, due to their geographic location and precarious constructions. This can be seen in the following sequence.

Although residents are satisfied with the post-fire reconstruction, they would suffer the same damage in a future event, either due to the material nature of the reconstruction (wood), the lack of regulation in informal settlements, or the lack of concern on the part of the authorities.

Figure 1. Sequence of damage and reconstruction in the fire area. Source: own elaboration.



The sequence first shows what the town looked like before the fire. Then, in April 2014 how devastated the shot was, and thirdly it shows the rapid reconstruction since in August of the same year it was almost completely rebuilt again. If we compare the photograph before the fire (from January 2014) with the photograph of 2016 we see very little change, which speaks of a hasty reconstruction where precautions are not taken, and the same mistakes are made again (Figure 1).

Although Cerro La Cruz seems to be regularized, there is still a sector where land grabbing continues to be the way to appropriate land. At the end of El Vergel Street, where the pavement ends and becomes a dirt road, there is another reality, where one can see the clear contrast in the quality of housing. This sector, being one of the most affected by the 2014 fire, the residents state that despite the great damages they suffered, the recovery helped them to improve their quality of life.

A new neighborhood program: a proposal for urban resilience

By combining the data obtained above, it can be concluded that there are two ways to act with respect to fire resilience in Cerro La Cruz: at the infrastructural level and at the social level.

At the infrastructural level, it is understood that it should be built considering three basic points: Evacuation, fire resistance, and avoidance of propagation. At the social level, it is required to build a cultural base on the hill that contributes with education and human resilience to the catastrophe.

It is proposed to implement a neighborhood council space, where there is a socio-cultural education program for children and neighbors in terms of evacuation and resilience. On the other hand, it should also be understood that the neighborhood councils must comply with spaces to prevent catastrophes, allowing for expeditious evacuation, fire resistant and avoiding propagation. In addition to choosing appropriate materials.

Since El Vergel Alto is the most affected area, the most remote and the only one on the hill without a neighborhood council, it is proposed to establish a new neighborhood space in this sector to develop the resilience program from a social and infrastructural level, becoming a triggering point for new permanent housing projects and improvement of existing housing projects.

Social Preventive System cerro La Cruz

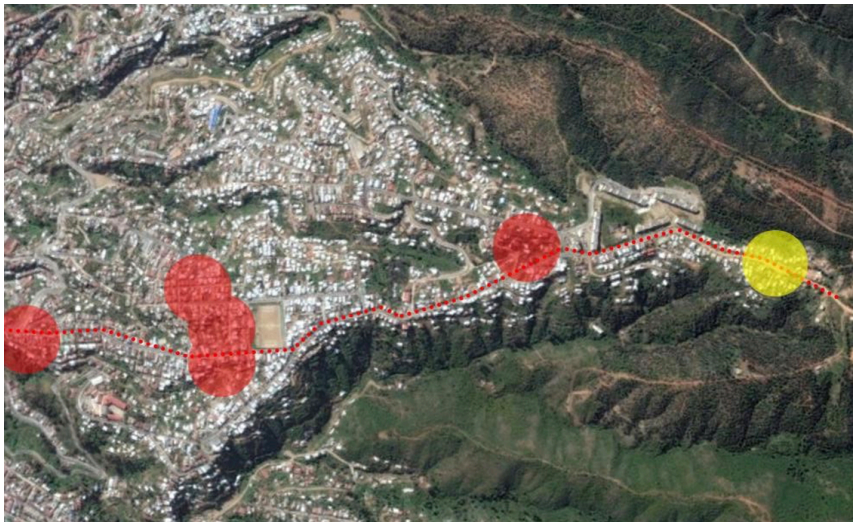
It is possible to take advantage of the community networks that already exist in Cerro La Cruz as a Social Preventive System, so that the most expeditious evacuation route is one of the five existing social centers [In red] as shown in the following diagram.

On the other hand, the infrastructural deficiencies of the population of El Vergel Alto, provides the opportunity to propose a sixth social center [In yellow] in La Cruz hill, to involve the people of this area to the Social Preventive System, also functioning as a triggering project of the next definitive housing of the place and functioning as the beginning of the evacuation axis.

What is sought with this, apart from generating a well-established evacuation axis, is that the hill, from its social centers, becomes a system in itself, that is to say, that the five existing social centers plus the proposed social center, deliver a fire education program to children and neighbors, that promote and take care of the cleaning of waste and weeds. In this way, the hill, from minor architectural operations, can become, thanks to the education of the people, a resilient place to anthropic catastrophes such as fire.

Finally, understanding the final proposal, emphasize how to address the problem. Understanding that at the regulatory and infrastructural level is not enough to make communities resilient to fires. It is necessary, starting from the community, to promote education, social inclusion and citizen participation, in order to avoid punctual solutions and generate an urban project that responds to the different needs (Figure 2).

Figure 2. Schematic proposal for the location of community facilities. Source: own elaboration.



Conclusions

The ravines of Valparaíso are today a social problem that has been growing throughout the history of the city. The imminent risk that these settlements run due to their geographic conditions is very great and has been reflected in the more than 70 annual fires they face, which represent one of the highest rates in the region. It is urgent to begin to understand Valparaíso as a unit that includes both plan and hills and ravines. For this it is necessary to propose a new urban planning program that renews, enables and understands from its inhabitants the needs of these potential urban connectors that are the ravines. Through projects that incorporate sustainability and socioeconomic factors, we will be able to think of a safer and more habitable Valparaíso that maintains the urban imaginary that the informal constructions located on these low-cost properties have formed in the collective national and international conscience.

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Graphic synthesis and visual intelligibility in Risk Communication: A semiotic analysis of MINSAL's preventive materials during the COVID-19 pandemic

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This chapter forms part of doctoral research on information design and risk communication, focusing on the process of graphic synthesis in preventive infographics during the COVID-19 pandemic in Chile.

Introduction

The COVID-19 pandemic exposed a critical global challenge: the need for visual communication strategies that combine technical effectiveness, interpretive universality, and cultural relevance in contexts of high uncertainty. In this scenario, graphic design—particularly information design—emerged as a key tool for translating complex epidemiological information into accessible visual messages that fulfilled informational, normative, and instructional functions during the health crisis.

This chapter examines the role of graphic synthesis, understood as the process of visually reducing content while preserving a message's semantic core through the elimination of redundancies, and its impact on the intelligibility of preventive campaigns. The central research question is: How does the degree of graphic synthesis relate to the comprehension of preventive messages, considering sociodemographic variables such as age, educational level, and cultural context?

The primary objective is to empirically evaluate the correlation between levels of iconicity and the communicative effectiveness of visual materials disseminated by Chile's Ministry of Health (MINSAL) from 2020 to 2021. To achieve this, the study proposes an analytical framework with three key dimensions:

- Representational Techniques: Identifying graphic methods that optimize representational accuracy in public health visuals.
- Differential Intelligibility: Analyzing how sociodemographic factors mediate the comprehension of messages at varying levels of abstraction.
- Communicative Function: Examining the relationship between visual synthesis and the intended message objectives (informative, behavioral, or instructional).
- The central hypothesis posits that the degree of graphic synthesis in MINSAL's infographics (2020–2021) significantly influenced their intelligibility, with systematic variations across different sociodemographic profiles.
- To assess the communicative effectiveness of these infographics, the original messages were experimentally redesigned at three levels of graphic synthesis: high, medium, and low.

This study's contributions extend beyond the theoretical realm of information design, offering practical guidelines for public health campaigns in crisis contexts. The results demonstrate that effective graphic synthesis is not merely a stylistic choice but a situated communicative act in which the selection of graphic codes must balance technical precision, cognitive accessibility, and cultural resonance. The study also highlights the importance of choosing appropriate referents aligned with communicative objectives.

Situated semiosis: microsigns and communicative functions

In information design, graphic synthesis operates as both a visual refinement technique (Kress & van Leeuwen, 2006) and a semiotic strategy for cultural adaptation (Ledesma, 2013).

This dual conceptual and practical nature requires a theoretical framework integrating three interrelated dimensions.

First, iconicity and sign economy present a fundamental paradox: Bertin (1967) emphasizes structural visual variables as the compositional agents of intelligible schematic messages. Yet, the formal universality of graphic synthesis often contrasts with the need for local referentiality (Costa, 1998).

While iconicity scales such as Villafañe's (2006) associate abstraction with pragmatic functions, they are insufficient for understanding and designing complex instructional messages (e.g., descriptions of medical symptoms) where semantic precision outweighs stylistic simplification. Standards such as ISO 9186 require greater accuracy and detail in sinsign classification. As a result, sign economy becomes more relevant for optimizing legisigns than for refining sinsigns. Second, the semiotics of visual representation reveals significant conceptual tensions. Dondis's (1998) critique of a universal "visual grammar" aligns with the polysemic nature of Peircean sinsigns (1931), which demand contextual interpretation (Acaso, 2006). This ambiguity intensifies in the iconographic domain—whether as image-icons, symbol-icons, or metaphor-icons—challenging rigid semantic systems. Instead, visual representation relies on an additive logic (Neurath, 1936), where microsigns (e.g., water droplets in handwashing pictograms) contribute meaning to larger signs. This process generates situated semiosis and enriches meaning according to communicative functions (Jakobson, 1975).

Finally, risk information design faces an ethical dilemma: reconciling "graphic excellence" (Tufte, 1983), which seeks to eliminate redundancies, with the imperative for clarity in multicultural contexts or among audiences with low visual literacy (Pan American Health Organization [PAHO], 2011). This tension demands a continuous negotiation between formal variables (Bertin, 1967), cultural perceptions (Panofsky, 1987), and communicative objectives, transforming synthesis from an end in itself into a contextualized strategy. Ultimately, the effectiveness of information design in public health emergencies depends less on universal principles and more on its adaptation to specific sociocultural conditions. The intelligibility test results confirmed that comprehension of visual messages is linked to the level of graphic synthesis, particularly for single-reference signs functioning as monodiscursive icons. However, in signs composed of microsigns forming supersigns or complex signs, the initial referent selection and configuration emerged as the key factor. Here, graphic synthesis played a secondary role in intelligibility, subordinate to the semantic relevance of the original sign.

Figure 1. Graphic variations of the symptom "difficulty breathing" with a high level of iconicity. Differences in microsigns, such as mouth aperture and head orientation, were tested.

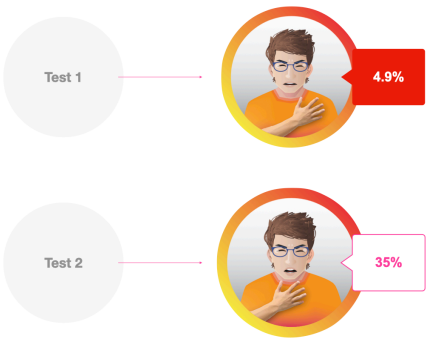


Table 1. *presents comprehension rates by graphic synthesis level and age group (N = 286):*

Age Group	High Iconicity	Medium Iconicity	Low Iconicity
18–29 years	84.3%	76.5%	66.2%
30–44 years	71.4%	66.0%	60.5%
45 years or older	79.1%	64.3%	52.6%
Overall mean	**78.3%**	**69.0%**	**59.8%**

As shown in Table 1, high iconicity levels were generally better understood overall, but age group analysis revealed significant differences: younger participants (18-29 years) demonstrated greater ability to interpret pictograms with lower iconicity (more abstract), while those over 45 years old understood high-iconicity versions better, particularly for conceptually more complex signs. This suggests that prior familiarity and visual experience condition sign interpretation.

Four key visual resources used in the synthesis were also identified:

- Cloning: Symmetric repetition of pre-coded forms.
- Zoning: Chromatic simplification in key areas.
- Geometrization: Use of regular structures to stabilize form.
- Suppression: Removal of micro-details that don't contribute to the message.

These techniques enabled optimized representation without sacrificing clarity—provided that the original sign was semantically valid. Conversely, when the image stemmed from a poorly defined concept, the synthesis amplified errors or confusion, thereby reinforcing the study's primary hypothesis.

Lastly, multiple correspondence analysis (MCA) revealed significant associations between educational level and preference for iconicity levels, suggesting that more synthesized signs require greater visual literacy for correct interpretation.

Conclusions

This research redefines the role of graphic synthesis in preventive infographic design, showing its true value lies not in aesthetic simplification but in its capacity to articulate culturally relevant and conceptually robust visual signs. Communicative effectiveness depends not solely on iconicity but on the interaction between visual referents, sociocultural contexts, and audience interpretive competencies.

A key contribution of this study is debunking the notion that simplification equals clarity. In public health risk contexts—where every message can have life-or-death consequences—graphic synthesis achieves its purpose only when built upon a well-defined semantic foundation. Ambiguous or unfamiliar original signs, no matter how refined, can distort messages and generate misinterpretations. This paradox requires redesigning protocols to prioritize conceptual and cultural validation before formal decisions.

Demographic factors, such as age, also modulate visual comprehension. Younger generations demonstrate greater adaptability to abstract codes, while older adults rely on explicit, highly iconic representations. Designing for diversity requires moving away from universal solutions toward segmented approaches that respect target group specificities.

These findings carry profound implications for professional practice, calling for a shift in the designer's role—from formal executor to critical mediator between information, culture, and perception. Interdisciplinary methodologies combining semiotic tools with empirical validation are essential to

ensure each graphic decision meets recipients' real needs.

As a future horizon, the study proposes developing theoretical-practical frameworks integrating three key dimensions: conceptual message solidity, cultural appropriateness of referents, and adaptive flexibility for diverse user profiles. Only in this way can truly effective visual systems for risk communication be created, where synthesis becomes a resource serving situated intelligibility.

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The Sustainable Development Goals: A Strategic Vision from the Prevention of Occupational Risks in Colombia

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This text arises from the project of the Autonomous University of Chihuahua, "Development and evaluation of a gluten-free bread with reduce calorie intake."

Introduction

University of Zaragoza (2024) states that the Sustainable Development Goals (SDGs), also known as Global Goals, represent a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity. These 17 Goals build upon the achievements of the Millennium Development Goals, while incorporating new areas such as climate change, economic inequality, innovation, sustainable consumption, peace, and justice, among other priorities.

Colombia, like many other countries, is committed to implementing the Sustainable Development Goals. Within this framework, particular emphasis has been placed on plans aimed at safeguarding employee well-being and safety, as established in the United Nations 2030 Agenda. Specifically, within the context of sustainable development and the prevention of occupational risks, there is now a growing discourse on equity through the inclusion of such factors within the labour sphere. In line with this plan, it is therefore appropriate to address these aspects when planning and executing related initiatives.

It is important to understand that Occupational Health and Safety (OHS) is not only a strategic factor that enables organisations to protect their human capital, mitigate risks in their value chain, increase productivity, and ensure business continuity, but also a key tool for achieving the Sustainable Development Goals set by the United Nations (UN). For instance, Goal 1 (End poverty in all its forms everywhere), Goal 3 (Ensure healthy lives and promote well-being for all at all ages), Goal 4 (Ensure inclusive, equitable, and quality education and promote lifelong learning opportunities), and Goal 8 (Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all). In this regard, the persistent lack of decent work opportunities, insufficient investment, and low consumption undermine the basic social contract that underpins democratic societies. The creation of quality jobs remains a significant challenge for nearly all of the country's economies (Red Pacto Global Colombiano, 2022)

Furthermore, the implementation of the SDGs in Colombia has entailed significant efforts to improve working conditions and promote a safe and healthy working environment, integrating the SDGs into the action plan for their achievement. It is therefore appropriate to highlight the importance of implementing this plan and the extent to which the learning and internalisation of the SDGs influence organisational practice and the daily operations of enterprises.

Figure 1. The SDGs Agenda 2030. Source: UN, 2015.



Goals

In the current context of the Sustainable Development Goals Agenda 2030 applied to organizations as a strategy in Occupational Risk Prevention in Colombia, this research focuses on the need to analyze and understand the actions implemented by companies in terms of sustainability, decent work and occupational safety for the integrity of workers' health.

To comprehensively understand how these preventive actions influence the improvement of working conditions and the culture of self-care in Colombian organizational contexts, we seek to carry out a systematic review of scientific and organizational bibliographic sources that allows exploring the regulatory frameworks and intersectoral alliances related to Occupational Risk Prevention in the fulfillment of sustainability in safe work environments.

Sustainable Development Goal 1: No Poverty – End poverty in all its forms everywhere

In Colombia, the most recent census report from National Administrative Department of Statistics (DANE, 2025) on monetary poverty in 2024 reveals a dual panorama: the percentage of people living in multidimensional poverty at the national level was 11.5%; in urban areas, it was 7.8%, while in rural and scattered regions, it reached 24.3%. This means that the percentage of people in multidimensional poverty in rural and dispersed areas was 3.1 times higher than in urban areas. This contrast highlights a general improvement in the economy and employment that failed to benefit the entire population equally, especially the most vulnerable groups in rural areas. Job creation and economic growth contributed to the reduction of monetary poverty; however, inflation, which reached 5.20%, significantly affected the most vulnerable social classes, thus limiting the positive impact of these economic advances (Moreno Saldoval, 2023).

Colombian companies, as Pelekais & Ortega (2020) note, are becoming increasingly aware of their corporate social responsibility (CSR) and are committed to the United Nations' 2030 Agenda and its Sustainable Development Goals. In particular, they strive to fulfil SDG 1, which aims to eradicate poverty in all its forms. Through Occupational Risk Prevention (ORP) and Occupational Health and Safety, they have significantly contributed to poverty reduction by improving working conditions and promoting access to safe and healthy jobs, which in turn increases individual income levels. It is important to remember that a vast number of informal workers are employed in precarious, unhealthy,

and unsafe conditions, with no social protection. Therefore, the formalisation of employment in terms of occupational safety and health is a key strategy to ensure that the country's workforce benefits from decent working conditions and access to social security, fostering a more inclusive, fair, and equitable labour market (González *et al.*, 2019) Furthermore, it is essential to consider that deaths and disabilities resulting from hazardous work activities are a significant cause of poverty, as affected families lose the productive capacity of their members, thereby setting back social progress and deepening inequality in access to opportunities.

Sustainable Development Goal 3: Good Health and Well-being – Ensure healthy lives and promote well-being for all at all ages

The practical implementation of Occupational Risk Prevention has a significant impact on achieving Sustainable Development Goal 3, which focuses on ensuring healthy lives and promoting well-being for all at all ages. The role of ORP and Occupational Health and Safety in achieving this goal is centred on health and well-being within organisations. It has been essential for ensuring safe working environments and improving the well-being of workers and communities.

Internally, companies implement a range of measures to support this goal, such as establishing health and safety management systems across all their facilities and requiring their suppliers to do the same, in order to reduce occupational accidents and illnesses throughout the value chain (Castañeda *et al.*, 2017). Moreover, companies adopt effective safety and hygiene protocols for their products and services to prevent negative health effects for consumers, offer regular health and safety training to employees, limit or eliminate the use of hazardous chemicals, and promote a healthy lifestyle among staff.

On the other hand, considering the need to strengthen measures to protect the health of members across the supply chain, Colombia aims to move towards renewable energies to reduce air pollution, manage energy consumption by promoting sustainable mobility, balance healthcare costs concerning employees' wages, and improve the nutritional quality of food and beverages in the agri-food sector to provide healthier options for consumers (Rodríguez-Guevara *et al.*, 2024).

Enterprises have various tools at their disposal to facilitate their contribution to SDG 3, which centres on health and well-being. These include applying the national regulatory framework, such as Law 1562 of 2012 and Decree 1072 of 2015, which establish guidelines for preventing occupational risks. Additionally, companies can implement occupational health and safety management systems, participate in training programmes, seek specialised advisory services, join business networks dedicated to promoting occupational health, and take advantage of incentives and recognitions offered by the government and other entities. These are all fundamental measures for ensuring safe work environments and promoting the well-being of workers in the country (Ministerio de Trabajo, 2015).

Sustainable Development Goal 4: Quality Education – Ensure inclusive, equitable, and quality education and promote lifelong learning opportunities for all

Through the National Ten-Year Education Plan 2016–2026, the Colombian government aims to enhance the quality of the education system, foster the country's economic and social development, and build a society grounded in justice, equity, respect, and the recognition of diversity. Its mission is to guarantee the right to education, considering the cultural and territorial diversity of the country, while eliminating the barriers imposed by citizens' socioeconomic conditions (MEN, 2017).

It is essential to note that, like other Latin American countries, Colombia is facing the challenges arising from the COVID-19 pandemic, particularly those related to the continuity of educational trajectories for children and adolescents, as well as the reintegration of those whose schooling was interrupted. The pandemic exacerbated pre-existing social inequalities and systemic issues, but it also presents an opportunity to rethink and transform national education systems towards greater equity and inclusion. This transformation involves leveraging technological and pedagogical innovations, as well as the commitment of educational communities and the efforts made during this unprecedented period, thereby contributing to the collective commitment to the 2030 Agenda for Sustainable Development (Rueda & Coronell, 2024).

In Colombia, several companies have taken on the challenge of contributing to SDG 4 by implementing educational programmes. For instance, companies in the electricity, gas, steam, and air conditioning supply sectors support early childhood education programmes, demonstrating their commitment to equitable early development (Gallego Navarro, 2019).

Various factors associated with the fulfilment of SDG 4 reveal that the impact of the pandemic on education exposes a profound crisis that directly affects the development of both basic and advanced skills among the population. The loss of learning and the lack of access to education have serious implications for the labour market and, consequently, for Occupational Health and Safety. Inequality in access to higher education, particularly among low-income groups, perpetuates a cycle of poverty and low-quality employment. These workers are often exposed to more hazardous and less regulated working conditions, which increases the risks of occupational accidents and diseases. The lack of social mobility, despite the increased access to education, suggests that many workers are not acquiring the necessary skills to access safer and better-paid jobs (FUNDEPS, 2021).

In this context, it can be inferred that improving the quality and equity of the education system has a direct impact on occupational risk prevention and OHS. Educational programmes that integrate training in occupational health and safety from early stages can better prepare future workers to identify and mitigate occupational risks. Likewise, quality education that is accessible to all can contribute to a more skilled workforce that is aware of the importance of OHS, thereby reducing the incidence of accidents and work-related illnesses.

Sustainable Development Goal 8: Decent Work and Economic Growth – Promote inclusive and sustainable economic growth, full and productive employment, and decent work for all

Sustainable Development Goal 8, focused on Decent Work and Economic Growth, advocates for inclusive and sustainable economic development, as well as the promotion of employment and decent working conditions for all. It aims to foster steady, inclusive, and sustainable growth by ensuring full and productive employment, as well as decent work, for all individuals. This goal aims to reduce unemployment rates, improve working conditions, and increase productivity, with a particular focus on protecting labour rights and ensuring safe working environments for all, including migrants and those in precarious employment, especially migrant women (López-Mera, 2020). Target 8.8 of SDG 8, which centres on Labour Rights and Safe Workplaces, aims to protect workers' rights and promote workplaces free from occupational hazards. This includes the rigorous implementation of Occupational Health and Safety regulations, the development of voluntary initiatives, and the constant updating of laws and systems related to OHS. Such measures not only encourage the creation of decent jobs and labour formalisation but also safeguard workers' rights and guarantee risk-free working environments. Moreover, they contribute to the eradication of forced labour and other forms of labour exploitation, such as human trafficking (Álvarez Duque *et al.*, 2023).

In Colombia, companies across various sectors are taking significant steps towards meeting SDG 8, which seeks to promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. In the agricultural, livestock, hunting, forestry, and fishing sectors, corporate social responsibility (CSR) initiatives are geared towards supporting local suppliers, thereby fostering national economic growth. This approach not only strengthens the local economy but also empowers communities by generating employment opportunities and supporting sustainable production (Gallego Navarro, 2019). This support is crucial for the development of new enterprises and the creation of employment, making a significant contribution to achieving SDG 8. Likewise, financial and insurance activities are linked to the creation of jobs and alternative sources of income for low-income families through collaboration with foundations and civil society organisations. This collaborative approach enhances social and economic inclusion, promoting more equitable and sustainable growth (López-Mera, 2020). Companies in Colombia play a crucial role in the country's economic development, accounting for the majority of employment and production. These companies, committed to the United Nations Sustainable Development Goals, have adopted sustainable practices that address global challenges such as poverty, hunger, and pollution. Corporate Social Responsibility and Occupational Health and Safety are key elements of their strategies, enhancing both their public image and the well-being of their employees and the communities they serve. In this way, they make a significant contribution to more equitable and sustainable development in Colombia. The Colombian regulatory framework, as represented by Law 1562 of 2012 and Decree 1072 of 2015, provides clear guidelines for preventing occupational risks. These laws have enabled companies to implement health and safety practices more effectively, thereby reducing occupational risks and promoting safer working environments.

Conclusions

The implementation of OHS policies and programmes within the existing regulatory framework in Colombia has not only helped to prevent workplace accidents and occupational diseases. However, it has also promoted healthier working environments, increasing productivity and the overall well-being of workers. Therefore, the promotion of OHS can drive sustainable economic development by reducing the costs associated with workplace accidents and occupational illnesses. Companies that invest in safe and healthy working conditions tend to experience lower rates of absenteeism and staff turnover, which in turn enhances operational efficiency and competitiveness. In this way, OHS benefits not only workers but also has a positive impact on the economy as a whole. Occupational Risk Prevention and Occupational Health and Safety in Colombia have played a significant role in achieving SDGs 3 and 4. These strategies have greatly improved the health and well-being of workers, as well as the quality of education in the country. Nevertheless, challenges remain that must be addressed in order to maximise the impact of these initiatives and ensure a more sustainable and equitable future.

Integrating Occupational Risk Prevention into the framework of the 2030 Agenda is essential for advancing towards global, sustainable, and equitable development. OHS is crucial for ensuring safe and healthy working conditions, which not only protect the lives and well-being of workers but also drive productivity and economic stability. By reducing the incidence of workplace accidents and occupational illnesses, the associated costs of medical care, compensation, and productivity loss are lowered, thereby freeing up resources that can be invested in other social and economic development programmes.

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Physicochemical and nutritional evaluation of a gluten-free bread with reduced caloric intake based on edible mushrooms

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Introduction

Bread and its flour-based products are fundamental components of the basic human diet. However, the prevalence of celiac disease is increasing (But, 2015). Celiac disease is defined as an autoimmune digestive disorder, where the mucosa of the small intestine is affected, triggered by gluten consumption (De la Calle *et al.*, 2020). The only known treatment to date is a diet free of this component (gluten), an important segment of the population that does not have any conditions related to gluten intake sees these products as a healthier food option. The current gluten-free baking market offers very few options, where commercial products are limited in their organoleptic and nutritional characteristics, often providing a caloric contribution like that found in traditional bread. For this reason, the food industry has initiated research on new ingredients for the formulation of gluten-free foods with greater nutritional value, better quality, and increase variety (But, 2015; De la Calle *et al.*, 2020). The objective of this work was to develop a gluten-free bread from the agro-industry by-product (broken rice) and edible mushroom flours (HC-mushroom, HS-mushroom and HH-huitlacoche), with functional properties, a better nutritional contribution and lower caloric intake.

Selection and conditioning of raw materials

Edible mushrooms such as sliced button champignon mushrooms (*Agaricus bisporus*) (Champimex), fresh huitlacoche (*Ustilago maydis*) (local market, Chihuahua), and seta mushrooms (*Pleurotus ostreatus*) (El Dorado) were used. Cracked polished white rice (Food Technologies Trading, Mexico) and xanthan gum (DCosmopolita, Mexico) were also used. Edible mushroom flours were prepared according to the methodology described by Hernández *et al.* (2023), with a modification in the drying time. Once the dry matter and cracked rice were obtained, they were ground using a blade mill (Hamilton Beach, 80350R, Mexico), and each treatment was sieved through a No. 60 sieve (250 µm). Rice starch was isolated using the methodology proposed by Ibáñez (2007), and subsequently modified based on the methodology described by Bello-Pérez *et al.* (2002). The obtained products were labeled and stored

under refrigeration (4°C) until their characterization and use.

Characterization of the raw material

Proximal Analysis. Determinations were made based on the AACC methodology (2000) through the following analyses: humidity (method 44-19), ether extract (method 30-25), proteins (method 46-13) and ash (method 08-01).

pH. Water Absorption Index (WAI) and Water Solubility Index (WSI). The pH analysis was performed according to method 02-52.01 (AACC, 2000), using a potentiometer (Hanna Instruments, Romania), while the WAI and WSI were determined using the methodology proposed by Anderson *et al*. (1982), using a centrifuge (Centra CL3R, Thermo IEC, USA) and a forced-air circulation oven (Ecoshel, Mexico). Both analyses were performed in triplicate.

Color. It was carried out based on ASTM D6290 (ASTM 2013), using a Miniscan XE 45/0-L colorimeter, USA). By acquiring the tristimulus values L* (luminosity), a* (tendency towards green -, or red +) and b* (tendency towards blue -, or yellow +) ΔE were obtained using a standard (L* = 97.36, a* = 0.34, b* = 2.36).

Preparation and characterization of gluten-free bread

Bread production. This process was carried out using the methodology reported by Serna-Saldívar (2012), in which each of the edible mushroom flours was mixed with the rest of the formulation and hydrocolloids based on a mixing design. The product was stored in polyethylene bags at 5°C until its characterization.

Height and specific volume. The height of the loaves was measured using the methodology described by Serna-Saldívar (1996), which is based on directly measuring the height of the loaf with a digital Vernier caliper (Mitutoyo, Japan). The specific volume was determined using AACC method 10-05 (AACC, 2000) with modifications, based on the technique of displacement of millet seeds in a container of known volume. These analyses were performed in triplicate.

Proximate analysis and caloric intake. Determinations were made based on the AACC methodology (2000) through the following analyses: moisture (method 44-19), ether extract (method 30-25), protein (method 46-13), and total dietary fiber (method 32-05). Nutritional intake was determined based on calculations using the nutritional components (carbohydrates, protein, and lipids) using the following ratio: Kcal = (4 (g of protein) + 4 (g of carbohydrates) + 9 (g of fat).

Texture profile analysis. This analysis was performed using the 66-50 method (AACC, 2000) using TAXT2i plus texturing equipment (Texture Technology Corp., Scarsdale, NY, USA). The hardness parameters was evaluated.

Experimental design and data analysis

An L-optimal mixture design was used, using the statistical package Design Expert V. 13 (State Ease, 2014) with the objective of seeing the effect of the concentration of the different ingredients in flours used on the response variables analyzed in bread (Height, specific volume and hardness). Three factors were analyzed: champignon mushroom flour (HC), huitlacoche flour (HH), and seta mushroom flour (HS), obtaining 9 treatments at a significance of $p < 0.05$. The analysis of the raw material and physicochemical properties of the bread was carried out by determining the standard deviation of the data and comparing means through the Tukey test ($p < 0.05$).

Proximate analysis of flours

The results obtained for the proximate analysis of the flours mostly show differences between them, which highlights the nutritional particularities of each one and their possible potential to be used in the elaboration of gluten-free products with an improved nutritional profile. NOM-247-SSA1-2008 establishes a maximum limit for the moisture content of the flours, which must be less than 15%. All the flours analyzed meet this requirement; however, huitlacoche flour (HH) presented the highest moisture content, with a value of 10.69 ± 0.24%. This higher moisture content could influence the texture and stability of the final product, especially with regard to its conservation, since higher humidity can increase susceptibility to microbiological deterioration. On the other hand, seta flour (HS) showed an intermediate moisture content of 8.16 ± 0.07%, while champignon flour (HC) recorded the lowest value of 7.39 ± 0.15%, suggesting that this flour could offer greater stability during storage, contributing to prolonging the shelf life of the final product. Regarding protein content, champignon flour (HC) showed the highest value (28.26± 0.05%), this result is higher than that reported by Gómez-Flores *et al.* (2019) with values of 14.4%, where its use in alternative diets is highlighted due to its protein contribution. Seta flour (MF) also showed a significant protein content (17.55 ± 0.16%) lower than what Oluwaseun *et al.* (2020) report (20.4 ± 0.3%), this is possibly related to the species of seta mushrooms and their cultivation conditions, especially the substrate used, while Huitlacoche flour (HH) had the lowest protein value (13.31 ± 0.17%), closely similar to the ranges reported by Beas *et al.* (2011) from 11.5 to 14.2%.

Seta flour (MF) showed the lowest fat content (1.93 ± 0.01%) compared to HH (3.42 ± 0.02) and HC (2.83 ± 0.26), however it is related to the value reported by Oluwaseun *et al.* (2020) of 1.6 ± 0.1, being this an ingredient of interest in the formulation of products seeking a reduction in fat content. Regarding the ash content, which reflects the mineral content of each flour, champignon flour (HC) presented the highest value (9.88 ± 0.11%), suggesting a high concentration of essential minerals, such as potassium, phosphorus and selenium (FEN, 2013) compared to the other flours. This mineral profile is beneficial for the fortification of gluten-free products, which often lack certain essential micronutrients. The flour that presented the lowest carbohydrate contribution was HC (51.33%) unlike HH and HS where there is no significant difference in both treatments. Various references (Infobae, 2024) highlight the low glycemic index in champignon mushrooms, huitlacohe and seta mushrooms, considering them as potential ingredients in the development of healthy products due to their low caloric intake and their benefit in regulating blood glucose.

Physical properties of the raw material

For the physical characterization of the flours, the analyses of water absorption and solubility index (WAI, WSI), pH and color (Luminosity- L* and color difference- ΔE) were considered. In Table 1, it can be observed that champignon flour (HC) presented a lower WAI (4.367 ± 0.093) compared to seta (HS) and huitlacoche (HH) flours, as well as a lower ISA (0.209 ± 0.004). Osorio-Tangarife *et al.* (2021) report that champignon flour has a moderate water absorption index (WAI of 2.1) and limited water solubility (WSI of 3.5), so the differences with respect to the present study are mainly due to the procedure during flour conditioning, being an indication that the flours obtained have functional properties. Segura-Campos *et al.* (2014) report that soluble fiber plays a key role in technological applications, since it allows regulating the water content in foods such as WAI and WSI. For AM, a higher WAI value (3.070 ± 0.120) and lower WSI (0.608 ± 0.006) were obtained than those reported by Galicia-García *et al.* (2024) of 2.470 and 1.485 in WAI and WSI, respectively, this difference is due to the concentration of acetic anhydride used. Regarding the pH, the HC and HH did not present significant differences, while in the HS the highest value was obtained (6.13 ± 0.01) which is within the range reported by González and Pérez (2020) of 5.5 to 6.5.

Table 1. *Physical properties of the raw material.* Source. Own elaboration.

Raw material	WSI	WAI	pH	L*	ΔE
AM	0.608± 0.006 a	3.070 ± 0.120 a	5.413 ± 0.087 a	99.82 ± 0.19 a	2.47 ± 0.07 a
HC	0.209 ± 0.004 b	4.367 ± 0.093 b	4.145 ± 0.026 b	53.1 ± 0.84 b	45.88±0.92b
HH	0.218 ± 0.012 b	5.868 ± 0.145 c	4.523 ± 0.040 b	36.13 ± 0.44 c	27.27±0.52c
HS	0.64 ± 0.04 a	12.31 ± 0.06 d	6.13 ± 0.01 c	73.76 ± 0.44 d	28.07 ± 0.07c

Mean ± standard deviation, Tukey test, values that do not share a letter for the same column are significantly different p<0.05. WSI: water solubility index, WAI: water absorption index, pH, L*: luminosity and ΔE: color difference. HC: champignon flour, HH: huitlacoche flour, HS: seta flour, and AM: modified starch.

In the colourimetric parameters of the variable flours, the highest L* value (99.82 ± 0.19) is present in the modified starch, indicating clarity or whiteness, as well as the purity obtained by removing the lipid and protein fractions from the starch (Mustofa *et al.*, 2024). This trend is corroborated by the low colour difference (ΔE) between the AM and control samples. The lowest L* value for edible mushroom flours was found in HH (36.13 ± 0.44), with no significant difference in ΔE between HH and HS. The highest value was found in HC (45.88 ± 0.92) due to enzymatic browning, which occurs in the drying process as a result of the oxidation of phenolic compounds and the polyphenoloxidase enzyme (Sánchez & Pérez, 2009).

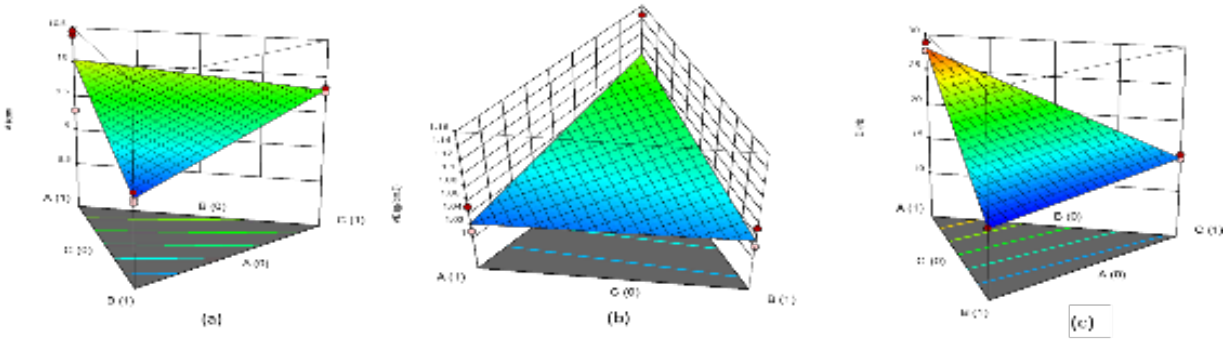
Proximal analysis and caloric intake of bread

In the moisture analysis, the treatments prepared did not present significant differences, with values that did not exceed 46%. These values are closely related to the range of 45.47% to 47.78% reported by da Costa *et al.* (2021) for gluten-free bread, and higher than that reported by Al-Atijawi and Almusawy (2021) in bread with 15% mushroom flour (15.3%). Regarding protein, the treatments made from HC presented a higher protein value (10.96 ± 0.06) unlike HH and HS. Ndung´u *et al.* (2015) mention that the incorporation of edible mushroom flour (5-15%) as a supplement in the bread formulation increases the protein content (14.8%) compared to the control (11.1%) (Al-Atijawi & Almusawy, 2021). The treatments obtained are closely related to these trends, as compared to commercial gluten-free breads. Escalona (2019) reports an increase in protein content in bakery products by incorporating 30% Pleurotus ostreatus flour, achieving values between 8.17% and 12.27%. These values fall within the ranges obtained in the present study, highlighting the high potential for developing gluten-free products that benefit consumer health. On the other hand, treatments containing HS had a low fat content (5.17 ± 0.07), ash (2.29 ± 0.02) and a higher carbohydrate content (36.49 ± 0.00), which reflects a lower energy intake (230.09 kcal), unlike the rest of the treatments. Galicia-García *et al.*(2024) indicates the energy intake of 290 kCal in a commercial gluten-free bread, presenting the treatments obtained a reduced caloric intake of up to 20.6% in HS.

Physical properties of gluten-free bread

For the physical characterization of the bread, the analyses of height (AL), specific volume (VE) and hardness (D). For the height response variable (AL), regression analysis showed that AL was influenced by the linear components X_1, X_2, X_3 (A, B, and C, respectively) at p<0.01. The prediction model for AL used the coded variables: $Y_{AL}=10.5X_1+9.04X_2+9.82X_3$. Figure 1a shows the response surface graph for the height variable (AL). The model obtained has a representativeness percentage of 66.39% ($R^2=0.6639$) with a p-value=0.0380, statistically significant at p<0.05. The highest AL value (10.03 cm) occurred at a higher concentration of HC, while the lowest value (8.97) occurred at a higher concentration of HH treatment, these values are within the range reported by Cajas (2018) from 8 to 11 cm in gluten-free breads, highlighting that under controlled process conditions factors such as the type of gluten-free flour, humidity and the mold influence the height of the bread.

Figure 1. Response surface graph for the response variables: a) Height, b) Specific volume, and c) Hardness. **Source.** Own elaboration.



For the response variable specific volume (VE), through regression analysis it was observed that AL was influenced by the linear components X_1, X_2, X_3 (A, B and C, respectively) at $p<0.1$. The prediction model for AL used the coded variables: $Y_{VE} = 1.02X_1 + 1.03X_2 + 1.09X_3$. Figure 1b shows the response surface graph for the variable VE, the obtained model has a representativeness percentage of 58.84% (R^2 = 0.5884) with a p value= 0.0697, statistically significant at $p<0.1$. The minimum VE value (1.02 cm^3/g) was presented at a higher concentration of HH, Mercado (2024) reported that a gluten-free bread with a lower specific volume is related to a denser and more compact bread, which can influence the appearance and consumer preference. For the hardness response variable (D), regression analysis showed that AL was influenced by the linear components X_1, X_2, X_3 (A, B, and C, respectively) at $p<0.01$. The prediction model for AL used the coded variables: $Y_D=28.09X_1+12.76X_2+14.76X_3$. Figure 1c shows the response surface graph for variable D. The model obtained has a representativeness percentage of 99.70% (R^2=0.9970) with a p-value=0.0001, statistically significant at $p<0.01$. The maximum hardness value (28.89 N) occurred at a higher concentration of HC, while low hardness values (12.73 N) were observed at the vertex of B1 corresponding to the highest concentration of HH. These values are closely related to those reported by Steffloani *et al*. (2014) of up to 22.49 N in gluten-free bread. Saw & Saidan (2022) reported that by incorporating 10% of edible mushroom in the formulation of a gluten-free bread, the hardness was reduced (19%), obtaining a softer crumb compared to the control (wheat-based bread). This trend is observed in the present study when comparing the treatments with the base formulation (without the addition of edible mushroom) of 18.79 ± 0.84 N, which when incorporating HH, the hardness decreased by 31%.

Conclusions

The use of edible mushroom flours, such as champignon flour, huitlacoche flour, and seta flour, presents a potential alternative for the development of gluten-free bread with improved functional and nutritional properties. The treatments analyzed have lower caloric intake compared to the commercial product, making them suitable not only for people with celiac disease but also for those seeking a healthy diet.

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Lighting specifications for housing: challenges for sustainability in the city of Chachapoyas

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Introduction

The district of Chachapoyas has a temperate climate, with moderate rainfall and temperature ranges. The city preserves many large houses in its historic center. It boasts beautiful landscapes that encourage rest and relaxation. It is considered a potential tourist destination, ranking third in importance nationwide, with accommodation being a potential source of economic income (MVCS, 2013). Housing is a space that reflects the living conditions of families in general. The predominant materials used to build homes, the services they offer, and the materials used in their construction are useful indicators for studying the conditions and needs of a population, as well as whether it contributes to the current demands for sustainable housing, SDG 11. The main principle of sustainable housing is to ensure reduced energy consumption (Addy *et al.*, 2017;García & González, 2020). Others authors like Campo & Roenneberg (2024); García & Zavala (2022) and Industries DURMI [D], argue that it is essential for housing to be designed with considerations that take advantage of natural light to achieve energy efficiency in artificial lighting systems, ensuring human health and well-being. This increases productivity, facilitates coexistence, reduces stress and anxiety, and more (VELUX, Halioua (2022) in Kaniel Agency [IK]).

In this regard Indriago *et al.* (2002) conducted an analysis of natural lighting and sunlight exposure with the aim of establishing parameters for the proper design of building openings (shape, size, protection, etc.) in a city with a hot and humid climate. They stated that light has been, is, and will continue to be a factor of great importance in the good design of buildings. The designer has natural light during the day to illuminate internal spaces and artificial light at night. The design of the home should consider optimizing the use of daylight in interior spaces, which will significantly reduce daily energy consumption for artificial lighting. The color of the walls, the colors of the furniture, the textures, as well as the treatment of the openings, the size and location of the windows and doors should be taken into account (Echevarría, 2012; Ponce de León, 2023; Villalpando-Flores *et al.*, 2019). The size of the windows in a house is a fundamental factor in determining the natural luminosity in it. The minimum size of these is a function of the percentage of the floor area of the environment to be illuminated and ventilated, according to Peñalva in (Ingeniería Real, 2025): bedrooms (16.7% of the floor area), living rooms (25%), dining rooms (20-25%), bathrooms (12.5%) and kitchens (20% of the floor area).

Sustainable housing design refers to the use of nature-friendly materials and techniques. Lasiewicz-Sych (2019) synthesizes the main factors that residents consider about housing architecture: functionality, comfort, aesthetics, sustainability and integration with the environment. But, also

integrating climate considerations in urban planning and building design is vital for adequate thermal comfort, ventilation quality and mitigating the negative impacts of climate change ensuring a sustainable future in cities (Bueno *et al.*, 2021; Romero-Pérez *et al.*, 2017; Salvati & Kolokotroni, 2023). In addition, factors such as outdoor temperature, indoor air quality and individual preferences play a crucial role in optimizing ventilation, comfort and energy efficiency in homes (Chen *et al.*, 2020; Delgado *et al.*, 2013).

Another study McGill *et al*. (2015) examined how different ventilation systems affect air quality in social housing in the United Kingdom. They stated that mechanical ventilation (a system that uses fans and ducts) promotes better air quality compared to homes with natural ventilation (a method that allows fresh air to enter through openings such as windows and vents). All of the above highlights the need for proper housing design. Therefore, the objective of this study was to determine the current housing gap in the city of Chachapoyas and the challenge of designing sustainable and energy-efficient housing. The usefulness of the research focuses on generating change towards living environments that offer a minimum level of comfort and harmony, including the Amazonian landscape offered by the city of Chachapoyas. The research also highlights the contribution of the city's inhabitants to sustainable development, as a city that contributes to energy efficiency and environmental conservation.

SDG 11 calls for sustainable cities and communities that contribute to a reduction in environmental impact. But, the elementary unit of cities or communities is housing. Rethinking our ways of life, including the space where we live, is fundamental. Although old houses already have a design that is typical of their time, they can be redesigned to optimize resources and contribute to a lifestyle that respects the natural environment, since having adequate thermal comfort and ventilation quality affect the well-being and improve the productivity of their occupants, as required (Bueno *et al.*, 2021; García & González, 2020; Lasiewicz-Sych, 2019).

Table 1. *Physical and construction characteristics of dwellings in Chachapoyas*

Socioeconomic status			**Building materials**			**The house was built by:**		
Category	**N°**	**%**	**Category**	**N°**	**%**	**Category**	**N°**	**%**
High	36	11	Noble Material	128	39	Bricklayer/Laborer	191	58
Medium	226	68	Adobe	191	58	Builder/Master Builder	52	16
Low	68	21	Other	11	3	Civil Engineer/ Architect	87	26
Total	**330**	**100**	**Total**	**330**	**100**	**Total**	**330**	**100**
Number of skylights			**Use of electric light during the day**			**Window size**		
Category	**N°**	**%**	**Category**	**N°**	**%**	**Category**	**N°**	**%**
0	119	36	Yes	112	34	Small (<6m^2)	138	42
1	189	57	Sometimes	136	41	Medium (de 6 a 10 m^2)	132	40
2	22	7	No	82	25	Large (> 10 m^2)	60	18
Total	**330**	**100**	**Total**	**330**	**100**	**Total**	**330**	**100**

In the city of Chachapoyas, homes face major challenges in achieving this level of sustainable housing. In most homes, the construction design was not carried out by a civil engineering or architecture professional (74%); these homes have not received specialized guidance on designing spaces that promote ventilation and natural light, which are fundamental parameters for housing comfort and ensuring the health of residents (McGill *et al.*, 2015). This is in agreement with Indriago *et al*. (2002), who consider that light will continue to be a factor of great importance in good building design.

Homes in this city are large, ranging from 150 m^2 to 200 m^2, 300 m^2, and even larger. The lighting parameters required to achieve a sustainable home are far removed from the characteristics of current housing design in Chachapoyas. Only 18% of the homes analyzed have large windows (>10 m2).

In most homes, moisture was observed (78%) visually (mold in passageways or flower pots), and it is very characteristic to perceive the smell of moisture when entering the home. In this regard, (Chen *at. al.*, 2020; Fernández-Agüera *et al.*, 2023) raised the need to promote a housing design that optimizes natural ventilation and controls humidity, thereby ensuring the health of its residents.

Most homes in Chachapoyas do not make efficient use of natural light. Their rooms are dark during the day. It was found that 34% of these homes use electric light during the day to illuminate their rooms, 41% of the homes evaluated sometimes use electric light during the day, especially when the weather causes it to get dark, and only 25% of these homes do not use electric light during the day to illuminate their rooms. This situation is not conducive to people's physical, psychological, and social health, as explained by Orr (2002), and highlights the urgent need to redesign homes to ensure energy efficiency, as explained by Vergara & Paz (2022).

Table 2. Assessment of minimum window size requirements in the homes analyzed

Category	Room: minimum 25% of floor area		Dining room: minimum 20% of the floor area	
	Number of dwellings	%	Number of dwellings	%
Compliant	91	28	87	26
Non-ompliant	239	72	243	74
Total	**330**	**100**	**330**	**100**

Data from technical sheet

Glazing is another important lighting parameter. In this regard, it was observed that 66% of homes have clear glazing and 34% have dark glazing. Thirty-eight percent of these have used light colors when painting the interior walls of the home, compared to 62% that have used dark colors. According to Ponce de León (2023), the color of the walls is important for reflecting light. Also (Echevarría, 2012; Villalpando *et al.*, 2019) highlight the importance of using light colors on walls, furniture, and even the distribution and texture of furniture in a room, as they favor light reflection.

In addition, according to the metric for comparing the size of the windows in the living room and dining room with the minimum established values, it has also made it possible to determine the lack of luminosity in the homes. It was found that in 72% and 74% of the houses, the living room and dining room, respectively, do not meet the minimum window size requirements. This lighting parameter is fundamental to determine the natural luminosity in the dwelling, according to Peñalva in (Ingeniería Real, 2025).

There is an urgent need for a redesign of the housing where specialists intervene to consider climatic situations, as considered by (Salvati & Kolokotroni, 2023) who highlight this factor to ensure sustainable cities. The changes should be culturally appropriate, protecting the cultural value of the city of Chachapoyas and according to the specifications of the local government entity (UE ProAmazonas, 2022).

Conclusions

Most homes in the city of Chachapoyas are characterized by the presence of adobe construction materials, the use of wood for doors, window frames and furniture. Inadequate window sizes, dark rooms, use of electric light during the day to illuminate their rooms, presence of humidity, inadequate skylight designs.

The lighting parameters required for housing in the city of Chachapoyas are: adequate size of windows, use of clear glazing, use of light colors on the walls and furniture inside the house, generating more ventilation spaces and natural light gain.

The social implications of providing the city of Chachapoyas with sustainable housing include an improvement in the quality of life and health of residents and visitors or tourists. In addition, it also has economic implications, as it involves savings in electricity and water costs, and the maintenance and construction of housing generates employment and boosts the local economy.

The main limitation of the research was gaining access to homes for visual and physical inspection. This work makes an enormous contribution, providing a solid foundation of useful information for future research related to the design and redesign of homes to overcome sustainability barriers.

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Exploring the potential of nature-based tourism through digital innovation: A case study from Río de Oro (Cesar, Colombia)

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This document is financed with resources from the Fondo Nacional de Financiamiento para la Ciencia, la Tecnología y la Innovación Francisco José de Caldas. The project is supported under the Contrato de Financiamiento de Recuperación Contingente No. 112721-141-2024

Introduction

The accelerated advancement of digital technologies is reshaping tourism worldwide, offering new tools to enhance visitor experiences, support environmental conservation, and foster inclusive development (Fatema *et al.*, 2024). In rural contexts, particularly in ecologically rich but under-resourced areas, nature-based tourism has become a viable strategy for linking biodiversity protection with local economic opportunities (Kuenzi & McNeely, 2008). This chapter presents a comprehensive territorial diagnosis of the municipality of Río de Oro, which identifies natural tourism assets, analyses existing tourism practices, evaluates community needs, and outlines opportunities for strengthening the local tourism ecosystem through a digital and sustainable approach.

Río de Oro is a territory of remarkable ecological, scenic, and cultural richness, characterized by a diverse hydrographic network and two strategic ecosystems: the Tropical Dry Forest (Bs-T) and the Premontane Humid Forest (bh-PM) (Alcaldía de Río de Oro, 2024). These natural features, combined with a vibrant cultural heritage and strong community identity, position the municipality as an emerging destination for nature-based tourism grounded in sustainability, environmental conservation, and community participation.

The methodological approach combined a documentary review—centred on the 2024–2027 Municipal Development Plan and local documents that reflect the cultural identity and traditions of Río de Oro—with primary data collection through field visits. These sources provided valuable insights into the municipality's vision for tourism, its environmental priorities, and the community's relationship with its natural and cultural heritage. The fieldwork enabled geospatial recognition of key natural assets and informal dialogues with community members.

The diagnosis provided in this chapter serves as a technical and strategic input for the design of nature-based tourism routes, digital promotion strategies, and local governance mechanisms aimed at fostering sustainable tourism in Río de Oro. Its primary goal is to support the development of a tourism model that places the natural environment at its core—leveraging biodiversity, ecosystems, and landscape identity as key assets—while integrating digital tools to enhance interpretation, accessibility, and visitor engagement. This model aspires to be not only digitally mediated but also ecologically responsible, culturally embedded, and socially inclusive, offering a replicable pathway for other rural areas seeking to strengthen nature-based tourism through sustainable innovation.

Nature-based tourism and sustainability

Nature-based tourism is a form of travel that takes place in natural environments, emphasizing environmental conservation, education, and low-impact experiences (Mehmetoglu & Normann, 2013). It includes subcategories such as ecotourism, scientific tourism, wildlife observation, and community-based rural tourism. According to the World Tourism Organization (UNWTO), this form of tourism is not only growing in popularity but is also considered a key pillar of sustainable development due to its

potential to generate income for local communities while promoting biodiversity conservation (World Tourism Organization & International Trade Centre and Enhanced Integrated Framework, 2017).

In the context of Río de Oro, nature-based tourism is linked to strategic ecosystems such as the tropical dry forest and premontane humid forest, which offer a rich array of biodiversity and landscape features. However, the sustainability of such tourism depends on the community's capacity to manage natural resources responsibly, develop locally-led experiences, and adopt innovative tools for visibility, promotion, and impact assessment.

Artificial intelligence and augmented reality for sustainability

Emerging technologies such as artificial intelligence (AI) and augmented reality (AR) are increasingly being explored in the tourism sector as tools for enhancing user experience and supporting sustainability goals. AI enables dynamic data analysis, automated customer interaction through chatbots, smart recommendations, and real-time translation—all of which can improve tourist services and accessibility, particularly in remote areas (Samala *et al.*, 2022).

Meanwhile, AR allows for the creation of immersive experiences by overlaying digital information (text, images, sounds, 3D objects) onto the physical environment through smartphones or smart glasses (Wei, 2019). In nature-based tourism, this can be used to interpret landscapes, visualize historical reconstructions, or animate local legends, all without causing physical impact on sensitive ecosystems.

Digital inclusion and territorial innovation in rural settings

Digital inclusion refers to the ability of individuals and communities to access, understand, and effectively use digital technologies (Nguyen, 2021). In rural settings—particularly in countries of the Global South—there are persistent gaps in infrastructure, digital literacy, and access to devices and connectivity (Salemink *et al.*, 2017). These gaps limit the ability of rural territories to fully engage in nature-based tourism enhanced by digital technologies, restricting opportunities for environmental education, sustainable promotion, and community-driven visitor experiences. However, when digital inclusion is prioritized, emerging technologies such as augmented reality and artificial intelligence can act as powerful enablers of territorial innovation. This concept goes beyond individual adoption, referring to the capacity of entire communities and regions to integrate knowledge, culture, and technology into their development processes. In rural and ecologically sensitive areas, the effective use of digital tools depends not only on access to infrastructure but also on the active involvement of local populations in shaping how these technologies are designed and used. Co-creating digital experiences that reflect local narratives, ecological knowledge, and community values allows for more meaningful, inclusive, and sustainable applications of AR and AI in nature-based tourism. Such an approach ensures that technology becomes a vehicle for empowerment and cultural continuity, rather than an externally imposed solution.

Territorial profile of Río de Oro (Cesar)

Located in the southeastern region of the Cesar Department, within Colombia's Caribbean zone, Río de Oro offers a rich and diverse territorial configuration that combines ecological wealth, historical depth, and cultural resilience (see Figure 1). Founded on August 1, 1658, Río de Oro occupies a strategic position in the foothills of the *Serranía del Perijá*, a mountainous subrange of the Eastern Andes. This location defines the physical landscape of the territory and shapes its environmental resources and tourism potential. The municipality has long remained outside the mainstream circuits of Colombian tourism, yet its combination of natural beauty and cultural traditions presents clear opportunities for sustainable, nature-based tourism development.

Figure 1. Panoramic view of Río de Oro from *Cerro de la Cruz*. This elevated viewpoint offers a sweeping landscape of the municipality, showcasing the transition between urban areas and surrounding natural ecosystems, including the foothills of the *Serranía del Perijá*.



Río de Oro is composed of both urban and rural zones. The urban area, where the municipal government and main services are concentrated, acts as a gateway for tourism access and logistics. In contrast, the rural area, organized into veredas and corregimientos, contains the municipality's most valuable ecological and scenic assets. These rural zones are characterized by a mosaic of agricultural landscapes, forest remnants, and hydrological corridors. Community-based livelihoods in these areas are primarily agricultural, although there is increasing interest in diversifying income sources through eco-friendly tourism activities.

The territory is home to two strategic ecosystems of great environmental and ecotourism significance: the tropical dry forest and the premontane humid forest. The tropical dry forest, located at lower altitudes and in more accessible areas, hosts a variety of endemic flora and fauna adapted to seasonal water scarcity. It provides ideal conditions for birdwatching, plant identification, and environmental interpretation. The premontane humid forest, found at higher elevations within the *Serranía del Perijá*, offers dense vegetation, cooler climates, and more abundant hydrological resources, making it well suited for immersive ecotourism experiences such as hiking, scientific expeditions, and community-led conservation tourism. Both ecosystems deliver vital ecosystem services, including water regulation, climate moderation, and biodiversity protection, which are essential for both human well-being and the sustainability of tourism initiatives.

The hydrological and orographic characteristics of Río de Oro further enhance its attractiveness for nature-based tourism. The municipality is traversed by a network of rivers and streams, including Las Marcelinas Waterfall, a key natural attraction due to its scenic beauty and cultural symbolism. The terrain features sharp elevation changes, panoramic viewpoints like the *"Fin del Mundo"*, and mountainous trails that connect different parts of the rural landscape. These features not only create opportunities for adventure tourism and landscape appreciation but also support narratives of cultural and spiritual connection with nature.

Nature-based tourism assets and potential

The municipality of Río de Oro possesses a diverse array of natural attractions that, although currently underdeveloped in terms of infrastructure and formal services, offer significant potential for sustainable tourism initiatives. The findings from the diagnostic revealed not only a rich environmental and cultural landscape, but also a growing interest from local communities in tourism as a development strategy grounded in ecological stewardship and cultural preservation.

Among the most emblematic attractions is *Las Marcelinas* Waterfall, a site of striking natural beauty located within the tropical dry forest ecosystem. Beyond its visual appeal, the waterfall holds cultural and spiritual significance for local residents and is surrounded by biodiversity-rich habitats ideal for

guided ecological interpretation, nature photography, and wellness-oriented activities such as meditative walks. Another key attraction is the "Fin del Mundo" viewpoint, a panoramic ridge that offers breathtaking views of the *Serranía del Perijá* and the surrounding valleys.

Other potential tourism assets include ecological trails, rivers, forest patches, and highland sites with minimal anthropogenic alteration. These areas are suited for a range of low-impact tourism activities such as birdwatching, scientific expeditions, botanical exploration, and community-led storytelling walks that integrate natural observation with local myths and environmental knowledge. The *Serranía del Perijá* itself, which frames the municipality's landscape, represents an underexplored corridor of biocultural richness, offering opportunities to develop thematic routes focused on biodiversity, traditional ecological knowledge, and climate adaptation strategies.

In terms of tourism typologies, the territory lends itself to various modalities of nature-based tourism. These include ecotourism, with emphasis on conservation and interpretation; scientific tourism, targeting researchers and academic institutions interested in the municipality's ecosystems and species; and cultural tourism, built around the traditional practices, legends, and artisanal knowledge of the rural population. The diagnostic also identified forms of religious and spiritual tourism, associated with local pilgrimage sites and sacred natural landmarks.

The analysis of local tourism demand and community perspectives was informed by informal conversations and observations gathered during fieldwork with local leaders and community members. While current visitation remains limited and primarily associated with annual festivals or religious events, there is growing local awareness of the potential of nature-based tourism to generate sustainable income, promote environmental stewardship, and reinforce cultural identity. Community members expressed a strong interest in developing tourism initiatives rooted in the natural landscapes of Río de Oro—such as ecological trails, waterfalls, and forested areas—highlighting their willingness to participate in models that are inclusive, environmentally respectful, and aligned with broader strategies for sustainable territorial development.

Nevertheless, stakeholders also identified key limitations: insufficient training in tourism services, lack of official recognition or signage for natural attractions, weak institutional support, and digital exclusion. These challenges reaffirm the need for capacity-building processes, community participation mechanisms, and the introduction of digital tools that can mediate and enhance the tourism experience without disrupting the integrity of the natural and social environment.

Challenges and opportunities for digital innovation

The integration of emerging technologies such as augmented reality and artificial intelligence into nature-based tourism requires a nuanced understanding of both the existing limitations and the latent opportunities within rural territories. In the case of Río de Oro (Cesar), the diagnostic revealed a complex landscape where infrastructural gaps coexist with high community interest and ecological potential, offering fertile ground for strategic innovation.

One of the most pressing challenges is the limited tourism infrastructure, particularly in the rural zones where most natural attractions are located. There is a lack of formal trails, rest areas, sanitation facilities, and interpretation centers. Moreover, signage is minimal or nonexistent, making it difficult for visitors to locate or understand the ecological and cultural value of sites such as *Las Marcelinas* Waterfall or the *"Fin del Mundo"* viewpoint. This situation not only reduces the accessibility of these spaces but also limits their potential to provide educational and transformative experiences. Digital connectivity is another significant barrier. Many rural areas in Río de Oro suffer from weak or intermittent internet access, which restricts the implementation of real-time digital services and limits local participation in digital content creation. Without reliable infrastructure, the deployment of AI-driven tools such as virtual assistants or geolocation-based AR experiences would face serious technical obstacles.

Despite these challenges, the diagnostic revealed a strong community willingness to engage in tourism development, particularly when it is framed around sustainability, identity, and local benefit. Informal conversations and participatory exercises with residents, artisans, and local associations showed that there is readiness to co-create tourism experiences and to receive training in areas such as digital storytelling, environmental interpretation, and customer service. This social capital forms the foundation for inclusive innovation and local capacity-building efforts aimed at strengthening nature-based tourism in the municipality of Río de Oro.

From a strategic perspective, augmented reality offers promising applications in the interpretation of natural and cultural heritage. For example, AR can animate local myths and provide virtual ecological guides—all through mobile devices that are increasingly accessible. Artificial intelligence, on the other hand, can support the creation of personalized itineraries, automated tourist information services (chatbots), and dynamic feedback loops that allow for continuous improvement of the tourism offer. Importantly, these technologies should not be introduced as stand-alone solutions, but rather as tools that complement and elevate the local knowledge, and values already present in the community.

In sum, while technical and infrastructural barriers remain, the opportunities for digital innovation in Río de Oro are substantial. By prioritizing community engagement, context-sensitive design, and gradual implementation, AR and AI can become powerful instruments for transforming nature-based tourism into a catalyst for rural development, digital inclusion, and ecological awareness.

Conclusions and future directions

The diagnostic has revealed a compelling opportunity for the sustainable development of nature-based tourism in the municipality of Río de Oro (Cesar), grounded in its ecological richness, cultural heritage, and community willingness to engage in alternative forms of rural development. Through a combination of documentary review and fieldwork, we identified key natural attractions—such as *Las Marcelinas* Waterfall, the "Fin del Mundo" viewpoint, and the ecological corridors of the *Serranía del Perijá*—alongside valuable ecosystems like the tropical dry forest and the premontane humid forest. These environments are suitable for a range of ecotourism modalities, including scientific, cultural, and environmental education experiences.

However, the study also documented critical limitations in infrastructure, signage, and digital connectivity, which currently hinder the municipality's ability to host sustainable tourism flows or integrate digital innovation at scale. Despite these barriers, there is clear interest and willingness from rural communities to participate in ecotourism initiatives, particularly when they are designed to promote territorial identity, protect natural resources, and deliver direct socioeconomic benefits.

The findings suggest that the integration of digital technologies, such as augmented reality and artificial intelligence, holds significant potential for enhancing tourism experiences while contributing to environmental education and inclusive rural development. AR can be deployed to interpret landscapes, visualize historical or ecological narratives, and guide visitors through immersive trails. AI-based tools—such as chatbots or recommendation engines—can improve tourist interaction, assist with real-time information delivery, and support decision-making for tourism planning.

For future stages of development in Río de Oro, several recommendations emerge. First, it is crucial to strengthen local capacity-building, particularly in areas such as digital literacy, content creation, and sustainable tourism management. Second, any technological initiatives—such as the integration of augmented reality or artificial intelligence—should be grounded in participatory processes, ensuring that the resulting tools are culturally relevant, accessible, and aligned with community values. Third, addressing existing infrastructure and connectivity gaps will be essential, potentially through strategic partnerships with public institutions, educational organizations, and digital inclusion programs.

From a policy and research perspective, the case of Río de Oro underscores the importance of

promoting territorial innovation strategies that connect environmental preservation, technological adaptation, and cultural heritage. The experiences in this municipality may serve as a reference for other territories in Colombia and Latin America aiming to align their nature-based tourism potential with the principles of sustainability and digital transformation. Future research could explore the co-creation of digital content with local communities, the impacts of AR/AI applications on visitor behaviour and environmental awareness, and the role of local governance in shaping equitable, resilient, and community-centred tourism ecosystems.

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Social Commitment in the Prevention of Burnout among Coffee Growers

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Introduction

Burnout syndrome, also known as occupational burnout, is a condition that affects individuals subjected to high levels of work-related stress. It is characterized by emotional exhaustion, depersonalization, and a reduced sense of personal accomplishment (Osorio *et al.*, 2024; García & Osorio, 2024). This phenomenon not only reflects the deterioration of workers' mental health but also significantly impacts productivity and organizational performance, highlighting the need to address this issue from multiple perspectives, including individual, occupational, and community dimensions. In this regard, it is essential to recognize that working conditions directly influence overall well-being, making it evident that the development of preventive and intervention strategies is necessary to mitigate its effects (Osorio *et al.*, 2024).

Coffee farming, beyond its economic importance, holds deep cultural roots in many regions of the world, especially in producing countries such as Colombia, Brazil, and Ethiopia (Sacco dos Anjos *et al.*, 2011; Chaves, 2014; Ramírez, 2015). Coffee growers, who form the foundation of the coffee production chain, face numerous challenges that go beyond the occupational sphere and directly affect their overall well-being. Among these challenges are fluctuations in international coffee prices, the effects of climate change on crops, and dependence on a global demand that can be highly volatile (Viloria De La Hoz *et al.*, 2024). These dynamics generate constant economic and emotional uncertainty, affecting both quality of life and the ability to plan for the long term. Moreover, limited access to modern technologies and resources exacerbates the difficulties associated with production, increasing work-related stress among coffee growers.

Additionally, the geographical isolation of many coffee-growing communities limits access to basic services such as healthcare, education, and technology. This isolation not only worsens daily hardships but also reduces opportunities for coffee growers to receive psychological support or stress management training. This context of high vulnerability compromises not only the mental health of workers but also the economic sustainability of rural communities that depend on coffee production as their main source of income. The combination of these factors creates a favorable environment for the development of burnout syndrome, which affects not only coffee growers individually but also their families and communities. The impact on the family unit is particularly concerning, as stress and exhaustion often transfer to the home, generating additional tensions and conflicts. Globally, studies on occupational health in the agricultural sector have revealed that burnout in field workers is an underestimated problem. While there is greater awareness of psychosocial risks in urban and industrial settings, these issues tend to be overlooked in coffee farming and other rural activities. This is partly due to the invisibility of rural communities in public agendas and the mistaken perception that agricultural work, because it takes place in natural environments, is free from stressors. Additionally, the lack of consolidated data on mental health in agricultural communities hinders the implementation of public policies that effectively address this issue. Therefore, more attention must be given to generating scientific evidence that brings visibility to these conditions and justifies the allocation of resources for their resolution.

The impact of burnout is not limited to the individual who suffers from it. Its effects extend to the overall productivity of coffee farms, which in turn affects the competitiveness of the entire production chain

(Ministry of Labor, 2014). A physically and emotionally exhausted coffee grower is less capable of meeting market demands, which affects the quality of the final product and the income generated. Likewise, family and community dynamics are also disrupted, as burnout can lead to interpersonal conflicts and diminished social cohesion in rural areas. Furthermore, the lack of adequate infrastructure to manage mental health issues in these regions complicates the implementation of effective intervention strategies, perpetuating a cycle of exhaustion and low productivity.

Coping with stress involves strategies individuals use to manage and overcome difficulties (Lazarus & Folkman, 1984). Effective coping skills reinforce a sense of control and autonomy, whereas the absence of such tools can lead to maladaptive responses even to moderate levels of stress. In the case of coffee growers, the lack of psychological and social resources exacerbates their vulnerability to burnout, underscoring the need for interventions that strengthen resilience. This vulnerability is also influenced by the lack of training in psychosocial skills and the limited incorporation of preventive strategies into occupational well-being programs targeted at the agricultural sector. Moreover, promoting community support networks can play a crucial role in stress mitigation by providing a space to share experiences and develop collective solutions.

Given this situation, it is essential to conduct an in-depth analysis of the effects of burnout on coffee growers, understanding that this issue impacts not only workers' health but also the sustainability of coffee production— a key sector for many national economies. This article seeks to contribute to that understanding through a literature review aimed at identifying the most influential factors, coping strategies used, and potential interventions to address this issue. By making the realities of coffee growers visible, it is hoped that a broad dialogue will be encouraged among academics, institutions, and stakeholders in the production sector to generate effective and sustainable solutions. The implementation of comprehensive strategies will not only benefit coffee growers but also strengthen the global competitiveness and sustainability of the coffee sector.

Prevalence of Burnout among Coffee Growers

The prevalence of burnout syndrome among coffee growers is alarming, positioning it as a significant public health issue in regions where socioeconomic conditions are particularly adverse. Various studies emphasize that emotional exhaustion, depersonalization, and reduced personal accomplishment are the main dimensions affecting this population (Fennell *et al.*, 2016; Ordoñez, 2025). A central element is that coffee growers who rely exclusively on coffee farming for their livelihood face significant pressures due to the volatility of international coffee prices, high production costs, and increasing competition in the global market. These dynamics create an environment of uncertainty that intensifies chronic stress. In regions with limited access to economic and technical resources, the impact of burnout is even more pronounced, affecting not only individuals but also their families and communities. Moreover, the long working hours—from sunrise to sunset—combined with the physical nature of the work, increase levels of physical and emotional exhaustion. This generates a vicious cycle where chronic fatigue reduces productivity, which in turn increases stress levels among coffee growers.

Risk Factors Associated with Burnout

Financial stress: Financial stress is one of the main triggers of burnout. Coffee growers' dependence on the income generated by their harvests makes them vulnerable to market price fluctuations, high costs of agricultural inputs, and debt incurred to maintain their farms (Guillén *et al.*, 2017). This constant economic stress generates anxiety and concern, affecting both mental and physical health.

Climate change impact: Climate change emerges as a critical factor exacerbating stress among coffee growers. Alterations in weather patterns, such as irregular rainfall, prolonged droughts, and extreme temperatures, directly affect crop yields (Viloria De La Hoz *et al.*, 2024). Drought, in particular, has been linked to numerous adverse health outcomes, including deteriorated air quality and increased

pollutants that worsen respiratory conditions (Berman *et al.*, 2017; Salvador *et al.*, 2019; Demetillo *et al.*, 2019). It also increases the incidence of mental health issues, such as psychological distress and depressive symptoms. Research suggests that coffee growers' perception of climate change is key to understanding ongoing adaptation strategies, but also reveals many communities' limited capacity for action (Zuluaga *et al.*, 2015).

Recognition and institutional support: The absence of governmental programs and institutional support for coffee growers in times of crisis is another risk factor. Many workers feel their efforts are neither valued nor recognized, increasing demotivation and the sense of isolation.

Health Impact

Physical health: Coffee growers affected by burnout report a higher incidence of musculoskeletal disorders due to the physical demands of their work. Additionally, prolonged exposure to sunlight, handling of agrochemicals, and lack of access to personal protective equipment worsen health conditions (Ramírez *et al.*, 2022).

Mental health: In terms of mental health, anxiety and depression levels are significantly high among coffee growers. However, the lack of access to mental health services in rural areas limits the possibility of early intervention and treatment. Recent studies have shown that agriculture is a high-risk activity in terms of mental health, with alarming rates of depression, anxiety, and suicide among this population (Hagen *et al.*, 2019; Jones-Bitton *et al.*, 2020). Particularly concerning is the high incidence of suicide among male farmers, whose rates far exceed those of other demographic groups (Bryant & Garnham, 2015; Barry *et al.*, 2020). This underscores the urgent need to develop comprehensive strategies that prioritize mental health in public policies aimed at the agricultural sector. Other studies point to multiple stressors, including the coffee crisis, access to basic services, and climate (Schroth *et al.*, 2009; Eakin *et al.*, 2011; Frank *et al.*, 2011; Eakin *et al.*, 2014; Bacon *et al.*, 2017). Globally, literature on small producers' adaptation decision-making focuses on perceptions of extreme weather events, climate variability, trends, or a combination of these. This is compounded by the lack of access to modern technologies that could optimize agricultural processes and reduce workloads, leading to emotional exhaustion and low personal accomplishment.

Coping Strategies

Although coffee growers employ various coping strategies to manage stress and burnout, many of these are insufficient to address the structural causes of the problem.

Informal support networks: Community support networks, such as family and neighbors, play a crucial role in providing emotional and material support. These networks are an important source of cultural resilience that enables coffee growers to endure adversity. However, their reach is limited when economic or climatic crises affect the entire community.

Participation in cooperatives: Membership in cooperatives has proven to be an effective strategy to reduce work-related stress. These organizations offer technical training, financial assistance, and access to more stable markets, which reduces economic uncertainty (Villas *et al.*, 2018) In addition, cooperatives foster a sense of belonging and solidarity that mitigates feelings of isolation.

Resilience and active coping: Cultural resilience and active coping are common traits among coffee growers who manage to overcome difficulties. These strategies involve taking a proactive attitude toward challenges, setting clear goals, and seeking innovative solutions to optimize production processes (Maciuba *et al.*, 2013; Bahamon *et al.*, 2022). However, individual strategies must be complemented by structural interventions to achieve sustainable impact.

The analysis of burnout syndrome among coffee growers reveals a multifactorial issue that cannot be understood solely from an individual perspective. It must be addressed within a comprehensive

framework that includes the structural, social, and economic conditions faced by these rural communities. The findings of this documentary research emphasize the importance of linking the identified risk factors with the development of intervention strategies that respond to both the immediate needs of coffee growers and the broader challenges faced by the agricultural sector in the global context (Osorio *et al.*, 2024; García & Osorio, 2024).

A relevant point in the discussion is the impact of precarious working conditions on the development of burnout. Coffee growers, as the foundation of the coffee production chain, bear an intense workload that includes long hours under harsh weather, extreme physical demands, and constant economic uncertainty due to volatile coffee prices in the global market (Viloria De La Hoz *et al.*, 2024). These conditions not only increase occupational stress but also limit workers' ability to develop effective coping strategies. This is further compounded by a lack of access to basic resources such as mental health services, efficient production technologies, and social support networks, which deepens the inequalities affecting this population.

From a psychosocial perspective, burnout among coffee growers should not be understood solely as an individual problem but rather as a manifestation of an agricultural system that has historically prioritized production over human well-being. Economic fluctuations, climate change, and international trade dynamics have created a highly vulnerable environment in which coffee growers face constant pressure to adapt to ever-changing and often unfavorable conditions. This leads to a progressive emotional disconnection from their work, manifested in depersonalization and reduced personal accomplishment—key features of burnout (Osorio *et al.*, 2024).

A key finding is the link between the geographic isolation of coffee-growing communities and the lack of access to basic services. The remoteness of these areas from urban centers limits access to health, education, and technologies that could alleviate work-related stress. This isolation not only increases barriers to implementing effective public policies but also reinforces the perception of invisibility and abandonment by institutions, worsening mental health problems among coffee growers (Ramírez, 2015).

Another central issue is the need for intersectoral approaches that integrate intervention strategies from multiple fronts. Public policies must focus on ensuring decent working conditions, including fair wages, access to mental health services, and comprehensive well-being programs. Additionally, it is essential to promote mental health education within coffee-growing communities, emphasizing the destigmatization of mental illnesses and the development of stress management skills (Sacco dos Anjos, 2011; Chaves, 2014). Technology can also play a transformative role by implementing digital platforms that facilitate communication and access to psychosocial support resources. It is crucial to recognize the role of community networks and cooperatives as mechanisms of resilience against burnout. These organizations not only provide spaces for mutual support but also enable the sharing of resources and knowledge, fostering a sense of belonging and collaboration. However, their effectiveness depends on institutional support and the ability of coffee growers to actively participate in their management (Hernández *et al.*, 2014) Strengthening these networks requires joint commitment from governments, non-governmental organizations, and the coffee industry, ensuring that interventions are adapted to local realities and promote the comprehensive sustainability of the coffee sector.

Conclusions

The documentary analysis of burnout syndrome among coffee growers reveals that this issue is a manifestation of the adverse structural conditions under which the agricultural sector operates. Coffee growers face multiple challenges—from financial stress and climate uncertainty to the lack of access to healthcare services and modern technologies. These factors contribute to the high prevalence of burnout, affecting not only their physical and mental well-being but also the sustainability of coffee

production.

One of the main conclusions is that burnout among coffee growers cannot be addressed solely as an individual problem, but rather as a phenomenon that reflects systemic inequalities in rural areas. The absence of comprehensive public policies, the limited recognition of psychosocial risks in the agricultural sector, and the lack of effective intervention programs exacerbate this issue.

Addressing this challenge requires adopting multidimensional strategies that include interventions at the individual, community, and institutional levels. At the individual level, it is essential to promote mental health education and access to specialized services. At the community level, strengthening support networks and cooperatives can be a key tool for fostering resilience and improving working conditions. In this sense, research on burnout among coffee growers must continue to expand, incorporating empirical studies that deepen our understanding of the specific dynamics in each region and evaluate the effectiveness of different intervention strategies. Moreover, it is crucial to integrate the perspectives of coffee growers in the design of such initiatives to ensure that the proposed solutions respond to their needs and realities. One of the main challenges for the state, occupational health and safety professionals, and psychologists specializing in human talent within the agricultural sector is to develop and implement strategies that include campaigns and activities aimed at promoting mental health care and reducing stress and burnout syndrome.

Recognizing these symptoms early enables the adoption of effective measures, seeking professional support, and significantly improving job satisfaction in this sector. The well-being of coffee growers is an essential component for ensuring the sustainability of the coffee sector, which is not only economically relevant but also socially and culturally significant in many regions of the world. Therefore, addressing burnout syndrome is not only an ethical responsibility but also a strategic investment in the future of this activity.

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Sociocultural dynamics of the Feast of Saint Francis of Assisi in Quibdó: An analysis of Its impact on identity, community cohesion, and knowledge transmission

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Introduction

The Feast of Saint Francis of Assisi, or San Pacho, is one of the most emblematic cultural heritages of Quibdó. Founded in 1648 with a religious character (Ayala Santos, 2014), it has incorporated pagan and playful elements that reflect the sociocultural complexity of the Chocó region (Palacios Mosquera, 2014; Mendoza Zapata, 2020). Initially promoted by three foundational neighborhoods, it expanded to twelve Franciscan districts (Ramírez Machado, 2011). Recognized as Intangible Cultural Heritage of the Nation (2011) and of Humanity by UNESCO (2012), it is celebrated from September 3 to October 5, articulating memory, identity, intergenerational transmission, and social cohesion (Villa, 2013; Altahona Ruíz, 2015).

The Feast of Saint Francis of Assisi in Quibdó exemplifies a paradigmatic expression of Afro-Colombian socio-cultural festivity, encompassing symbolic, historical, and identity-based dimensions that transcend recreational forms (Pérez *et al.*, 2021). These celebrations serve as mechanisms of symbolic transmission and cohesion, fostering communal bonds and social capital (Cuyate *et al.*, 2014; Mendoza Zapata, 2020). As ritual condensers, they ritualize social meaning and reflect collective values (Sarricolea Torres & Ortega Palma, 2009), functioning also as spaces of cultural resistance and affirmation. Cultural identity is perceived as a dynamic process rooted in historical memory and symbolic reinterpretation (Hernández-Infante & Infante-Miranda, 2017; Brower Beltramin, 2014), and festivities contribute to this process by legitimizing identity in contexts of exclusion (Fernández Peña & Fernández Peña, 2012). However, patrimonialization also generates symbolic disputes and reinterpretations of the past (Martínez *et al.*, 2023). In Afro-Colombian settings, identity is often articulated through festive expression rather than explicit ethno-racial claims (Pazos-Cárdenas, 2014). Furthermore, intergenerational transmission occurs through experiential learning, supported by shared rituals (Gavilán & Carrasco, 2009). UNESCO (2012) acknowledges these practices as situated learning that require creative intergenerational dialogue to integrate memory, identity, and cultural transformation.

Perceptions of Cultural Identity and Community Belonging

Table 1. Assessment of the perception of the festivity and its sociocultural impact. Source: Author's own elaboration.

Aspects	Mean	Std. Dev.
Perception of the festivity	5,24	1,633
Impact of the festivity on social cohesión	3,82	1,183
Strengthening of cultural identity	5,19	1,683
Intergenerational transmission of traditions and cultural values	3,82	1,163

Table 2. Correlation matrix between dimensions. Source: Author's own elaboration.

Dimensions	General Perception	Social Cohesion	Cultural Identity	Intergenerational Transmission
General perception of the festivity	1,000	0,336	0,255	-0,000
Impact of the festivity on social cohesión	0,336	1,000	0,560	0,072
Strengthening of cultural identity	0,255	0,560	1,000	0,091
Intergenerational transmission of traditions and cultural values	-0,000	0,072	0,091	1,000

Note: Pearson correlation coefficient between the evaluated dimensions.
Interpretation of coefficients:

- < 0,3: weak correlation
- 0,3–0,5: low-moderate correlation
- 0,5–0,7: high-moderate correlation
- 0,7: strong correlation

The statistical analysis reveals a moderate correlation ($r = 0.336$) between the general perception of the festivity and its impact on social cohesion, with a coefficient of determination ($r^2 = 0.113$), indicating that this dimension accounts for approximately 11.3% of the shared variance. This suggests that although social cohesion is a relevant factor, it is neither the sole nor the predominant element influencing the overall evaluation of the celebration. This finding aligns with the argument presented by Sarricolea Torres & Ortega Palma (2009), who assert that festivities ritualize specific aspects of social life and act as condensers of symbolic meanings.

Regarding cultural identity, a moderately high correlation is observed with social cohesion ($r = 0.560$; $r^2 = 0.314$), confirming the link proposed by Hernández-Infante & Infante-Miranda (2017) between cultural identity and social integration. However, the weak correlation between general perception and cultural identity ($r = 0.255$), along with the absence of statistically significant associations with intergenerational transmission, suggests the presence of multifactorial evaluations and independent processes.

Figure 1. Yesquita neighborhood costume 2023. Source: Author's own elaboration.



Social cohesion and community relations

The findings on social cohesion and community relations reveal that 63% of respondents have participated in the Feast of Saint Francis of Assisi over the past two years, confirming its significance as a central socio-cultural expression in Quibdó. This substantial level of participation supports the assertion by Pérez *et al.* (2021), who argue that popular festivities function as symbolic mechanisms for transmitting shared behaviors and social codes. However, the 34% non-participation rate nuances this centrality, suggesting a heterogeneous pattern of community integration.

Moreover, 56% perceive an increase in social interaction during the festivity, which validates the view of Cuyate *et al.* (2014), who emphasize its role as a privileged space for collective encounter. Nevertheless, 29% do not perceive such an increase, and 15% remain undecided. Additionally, 59% believe that community relationships are strengthened, consistent with Mendoza Zapata (2020), yet the 27% who disagree and the 13% undecided underscore the diversity of perceptions—highlighting the need for a critical and context-sensitive analysis.

Intergenerational transmission and youth involvement

The analysis of youth participation in the Feast of Saint Francis of Assisi reveals that 78% of respondents perceive an active presence of younger generations, while 66% express interest in learning about and engaging with the associated cultural traditions. These findings provide empirical support for UNESCO's (2012) assertion regarding the pedagogical dimension of festivities as intergenerational spaces of situated learning. However, as Gavilán & Carrasco (2009) argue, cultural transmission is neither automatic nor mechanical; rather, it is mediated by individual experiences, contextual realities, and social interpretations.

The analysis of intergenerational transmission and youth participation in the Feast of Saint Francis of Assisi reveals a high perceived involvement of young people (78%), contrasted with a low percentage (11%) attributing this participation to explicit cultural interest. This discrepancy suggests the presence of alternative motivations such as socialization, entertainment, or peer pressure, which complicates the understanding of cultural transmission processes and distances them from a strictly preservationist logic. Regarding the sense of belonging, 47% believe the festivity strengthens it, while 19% disagree and 34% remain undecided, reflecting the dynamic and continuously reinterpreted nature of culture (Brower Beltramin, 2014).

Additionally, 75% acknowledge that the festivity enhances the appreciation of local traditions, aligning with Fernández Peña & Fernández Peña (2012), who assert that cultural identity is reinforced through the preservation of historical memory. However, contemporary tensions are reflected in negative or ambiguous perceptions about social cohesion and community ties (Martínez *et al.*, 2023), while Pazos-

Cárdenas (2014) and Guerrero et al. (2021) emphasize the need for a creative intergenerational dialogue that articulates memory and innovation.

Conclusions

The research demonstrates that the Feast Saint Francis of Assisi in Quibdó constitutes an essential mechanism for social cohesion, identity construction, and cultural transmission, albeit with differentiated impacts that demand critical analytical approaches. The celebration operates on multiple levels of meaning: it reinforces community bonds, projects collective identity, and facilitates intergenerational transmission of cultural knowledge. However, these processes are neither uniform nor always interdependent, highlighting the inherent complexity of sociocultural phenomena. The findings support the interpretation of the festivity as an expression of Afro-Colombian cultural resistance and adaptation, whose primary strength lies in its capacity for continuous re-signification without severing its connection to shared collective memory.

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Reflection on meta-evaluation in synchronous and asynchronous learning processes in the 21st century in the Ecuadorian education system. Is knowledge truly being constructed?

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Introduction

The 21st century has given humans the ability to access information that, some thirty years ago, could only be found in printed encyclopedias, with access to knowledge from verified study centers being a privilege enjoyed by few. This situation hindered progress in all professional fields, where all knowledge was concentrated in specialized universities or those with high educational standards, whose values or costs were not accessible to everyone, These factors undermined and created a social divide in education that prevailed for many years, especially in South America.

Today, with the widespread use of social media, the internet, and mobile devices, access to information is a daily activity that can be displayed in various ways. These developments have revolutionized modern education, as almost all sciences rely on different online applications and mobile devices, the latter being part of human life itself due to the benefits they offer in simplifying all social, financial, educational, and administrative activities.

After the COVID-19 pandemic, the full potential of multimedia-assisted education became evident, with synchronous and asynchronous classes being the only way to continue the global education system at all levels due to the mandatory quarantine adopted in all countries, which resulted in a transformation of existing educational standards for knowledge acquisition.

Despite these benefits, five years after the quarantine, there are questions about this learning process, which has become an alternative for elementary, middle school, high school, and university education because it allows for continuity in the educational process in the event of various situations that may arise, such as a natural or man-made disaster, a wave of violence, social unrest, or any other event that prevents face-to-face learning, all of which are part of the events that affect the normal development of activities in everyday life in Ecuador.

Now, with the aforementioned causes, how can we verify that synchronous and asynchronous learning have achieved their meso- and micro-curricular objectives? Is this process being carried out, or is it being overlooked for various reasons in the national education system? Is true knowledge construction taking place, or is it simply assumed that all educational processes in an institution are being properly executed? These and many other questions arise in light of the widespread use of online applications and mobile devices, whose use in education has become an normal activity, This leads to a balance between traditional face-to-face education and online education, the latter of which has characteristics

that require special consideration for the construction of knowledge, involving a joint effort between the institution, the curriculum, and the teacher in order to promote active learning in the student.

With this in mind, the objective of this paper is to analyze and reflect on meta-evaluation in synchronous and asynchronous learning processes in the Ecuadorian education system, in order to verify the construction of knowledge in these processes, which are widely used in Ecuador. Due to various existing situations, such as natural or anthropogenic events, this mode of study allows for continuity in the learning process. Therefore, meta-evaluation must be carried out in order to prevent this educational process from deteriorating or becoming a routine activity that does not promote innovation, the generation of ideas, connection with society, problem-based learning, and the active construction of knowledge.

Using a qualitative approach, this research employs deductive and inductive methods to generate ideas and conclusions from information obtained from open sources, supported by documentary and bibliographic research, in order to offer an alternative for implementing a meta-evaluation process in the Ecuadorian education system.

Meta-evaluation and its approach in the 21st century

Since the 21st century is marked by the constant use of technology, one of its applications being its use in different educational processes at all levels, which makes it a reliable tool that helps teaching staff and different educational institutions to achieve their objectives within their different curricular programs (Lastra & Aguayo, 2023) . Therefore, these processes require constant evaluation in order to measure any deviations or biases that may exist in the fulfillment of the General Teaching Plan, or that may exist due to events that prevent the execution of face-to-face classes.

It should be noted that evaluation, as a process inherent to the education system, needs to be carried out periodically. In order to verify that the evaluation is carried out expeditiously, meta-evaluation must be performed. This is a dynamic process that allows for the assessment of the methodology and instruments used to evaluate teachers, the curriculum, and the institution in general. which is why it constitutes an administrative and educational tool whose results must be handled professionally in order to avoid bias, subjectivity, or manipulation that obscures the educational reality of a curriculum at any level.

Now, with the widespread use of the technology mentioned above, meta-evaluation can be carried out in real time, that is, at a specific moment, with the results being shown either qualitatively or quantitatively, where the work of the evaluation team is directed towards a comprehensive analysis of these results.

In the 21st century, meta-evaluation is an internal process within each educational institution, the ultimate goal of which is to verify that the evaluation carried out can be measured and examined to provide real results that can be used to establish improvement plans. This reinforces the importance of carrying out meta-evaluation in an agile and professional manner, given that technological advances and constant updates in different areas of knowledge mean that research or advances from a given period of time total or partially relegated in the face of new knowledge generated. For this reason, it is necessary that meta-evaluation in the present century be a process that is carried out in a period of no more than two years, since it is necessary to keep up with advances in both technology and the areas of knowledge associated with it, and to meet the requirements of 21st-century education. (Hernández & Luna, Meta-evaluation of a teacher evaluation system from the student perspective, 2023)

Therefore, the approach to meta-evaluation in the 21st century must be comprehensive and holistic in order to verify the accuracy of the data obtained through evaluation, thus providing support for the institution or educational system that justifies the investment made by the institution and students,

while also validating the achievement of institutional and personal objectives of teachers and students, so as not to assume that the educational process adopted based on a teaching model or plan is correct, creating false expectations for the educational community and giving a poor perception of the learning process adopted, the consequences of which are not immediately visible, but rather are perceived in university or professional life, due to the gaps that may have formed during the school process, whether elementary or high school.

Intrinsically assuming that an educational model or teaching plan is optimal and functional is in itself a mistake on the part of managers and planners, since no process is perfect, as it is a joint, logical, and sequential effort that requires teachers to have a doctrine and conviction in order to transmit these values to students, so that the entire educational process is understood and practiced, and consequently, evaluations and, obviously, meta-evaluation can verify that the proposed goals have been achieved, avoiding unnecessary efforts, time, and costly investments. (Mears & Esquivel, 2024)

The need for meta-evaluation to verify learning with the influence of technology

Now, given the fact that the evaluations of a regional or national educational institution or system are biased or subjective, in order to produce results that justify the educational investment or the monthly fees charged, it is necessary to seek the reality and situational knowledge of the current state of the application of a teaching system or methodology (Avila, 2021) , with meta-evaluation being ideal for verifying learning in the present century, which is heavily influenced by technology.

The importance and influence of technology means that evaluations of the curriculum, teachers, methodology, and institutions can be developed in a very succinct manner or not given the importance they deserve, with very basic results, or with questions designed to elicit very superficial data that do not reflect the reality of the educational process, since it is assumed that a learning process that uses online applications or is interactive in itself builds knowledge, when in reality there are several factors that influence it. (Tipán & Jordán , 2021)

It should be noted that the design of a meta-evaluation process should focus on obtaining relevant data that allows for the verification of the questions applied and that the evaluation is in accordance with the meso-curricular and micro-curricular guidelines, as well as the exit profile of each student in each educational cycle, and that the results indicating the construction of knowledge or the achievement of the course objectives are obviously verified. (Medina, 2024)

Because learning must reflect the principles of 21st-century education, such as collaboration, critical thinking, and problem solving, measuring these principles is a challenge in an evaluation process within an educational institution, where the meta-evaluation process must ensure that this evaluation measures the degree of knowledge acquired by students and its application to real life in order to comply with the aforementioned principles.

From the evaluative measurement carried out, whether qualitative or quantitative, another milestone that makes a difference in executing meta-evaluation is determining whether the magnitude of knowledge acquired by students, as measured by the curriculum evaluation, is in line with the objectives of the educational community (Hernández & Luna, 2023), especially when technology is part of the learning processes, where the benefits of online applications used on mobile devices are often confused with the simplification of learning, or, failing that, in the learning process, the quantity of tasks performed with the help of multimedia diminishes their quality, making it necessary to seek a balance between quantity and quality and the consolidation of knowledge, which must be verified by the teacher-facilitator of the subject (Méndez & . This is where meta-evaluation measures how this verification has been determined, where a real or distorted result can be given, so it is necessary to

distinguish the validity of the measurements quantitatively and qualitatively by the group of professionals who will carry out the meta-evaluation.

Therefore, under the premises set forth, the meta-evaluation process must be carried out by a collegiate group that is objective, impartial, and preferably not part of the educational process, both in its planning and execution, actions that could give reliability and fairness to the meta-evaluation carried out, always seeking the educational and situational reality of an institution and its internal processes.

The execution of a meta-evaluation process can be aided by various online applications for data compilation or the display of results. however, a process of this magnitude must be carried out in person in order to qualitatively and quantitatively verify the results obtained in the internal evaluation, where on-site visits must also be made in order to validate the feelings and degree of satisfaction expressed orally by teachers, administrators, and students during an annual learning process or according to the proposed time frame, since it must be taken into consideration that in all areas there is a fear of failure as a teacher or as a student, as well as the existence of administrative retaliation for not achieving the proposed objectives, which are very demanding because this century has a very high competitive standard at all educational levels, even more so with the constant changes implied by the existence of a globalized world in all areas.

Build knowledge synchronously and asynchronously. Verify its effectiveness through meta-evaluation

As indicated, technology is a fundamental part of the learning process. To deny this would be an educational setback in formal education, where the management and compilation of information is currently an indispensable part of the active construction and generation of knowledge by students guided by teacher-facilitators. Therefore, the implementation and application of synchronous and asynchronous classes is currently a valid study modality in all educational fields and levels, with its benefits outweighing its supposed disadvantages, thus allowing for the continuity of education. (Mears & Esquivel, 2024)

In the complex daily system that Ecuador experiences, which is plagued by various factors such as crime, drug trafficking, natural and anthropogenic events, massive blackouts due to droughts affecting hydroelectric plants, mass layoffs as a result of the energy crisis, continuous states of emergency and curfews due to violence derived from drug and arms trafficking, makes synchronous and asynchronous modalities necessary to compensate for the lack of face-to-face learning in the national education system at all levels (Ecuavisa, 2023) , because, due to the various factors mentioned, these modalities are necessary to avoid prolonged interruptions that affect the learning process of students, the immediate effect of which is a loss of continuity, momentum, and willingness to learn on the part of the student, and in the case of the teacher, having to alter their face-to-face teaching methodology to adapt it to the synchronous or asynchronous modality according to the evolution of the situation experienced by the educational community. (De la Cruz, 2023)

Now, evaluating knowledge construction with asynchronous and synchronous modalities in the Ecuadorian system is inherently difficult, the most common reasons being a lack of the necessary means for these two modalities. In the case of synchronous classes, there is not enough connectivity or internet speed for a continuous class at home, or in most cases, there is not enough technological equipment in the home for a family with three or four children. For asynchronous learning, the difficulties are based more on the student than on the means, which can be summarized as not having a culture of research for completing tasks, a lack of true understanding that affects knowledge retention, or a lack of discipline to take classes in this modality in a specific r time frame, as well as a lack of understanding of the different methodologies, techniques, and tools applied in these classes.

Given the aforementioned difficulty, institutional evaluation in any Ecuadorian educational center is marked by these factors, requiring a redesign so that the questions reflect the reality of the learning process in a synchronous and asynchronous manner, where meta-evaluation must verify that these questions are correct and not biased in favor of the institutional or personal interests of administrators or teachers (Hernández et al., 2020) , which is why meta-evaluation must be a process without subjectivity and its design must focus on comprehensively verifying that the evaluation of the synchronous and asynchronous modalities is effective, and does not become merely a process to comply with the General Teaching Plan without verifying the construction and consolidation of knowledge in students, who, once the situation or crisis is over, will reveal any gaps they may have.

Therefore, meta-evaluation in the Ecuadorian system should focus on these modalities, which are very common, and in certain cantons or cities such as Durán, which experience high rates of violence, synchronous and asynchronous classes are a common option for private and public institutions.

Meta-evaluation must therefore verify that the results obtained are reliable and concrete and that it is carried out with the necessary responsibility, seriousness, and commitment. It is the obligation of administrators and teachers to ensure that these are carried out and that the results are not altered or interpreted in such a way as to justify existing shortcomings, but rather that it is an open field for meta-evaluation to discern and offer alternatives for change in light of the data obtained, verifying its biases or errors, allowing for the design of a new evaluation that has the virtues of being versatile, perfectible, and adjusted to the reality of the educational community to be examined (León, 2022) , and that it has the predisposition to be evaluated, since the worst enemy of the educational system is monotony and overconfidence, which lead teachers and administrators to intrinsically accept that all micro-curricular activities carried out on a continuous basis are effective and valid, and that, when moving to synchronous and asynchronous modalities, it is believed that the same methodologies, techniques, and instruments can be applied as in the face-to-face modality, a situation that creates distortions that come to light when students evaluate the curriculum.

Now, not carrying out a meta-evaluation of synchronous and asynchronous modalities in Ecuador leads to a return to monotony and overconfidence on the part of the institution, administrators, and teachers (Gonfiantini, 2020) , where it is assumed that the evaluation carried out offers a reality based on its results, where logically no system of any kind has total efficiency and effectiveness, requiring constant improvement actions through plans, as well as constant verification of all processes in order to maintain educational quality and institutional status, avoiding the loss of prestige by carrying out processes that do not offer sufficient practical education for the future work and professional performance of students.

Aspects to be considered by meta-evaluation in learning in the 21st century in Ecuador

The particularities of Ecuadorian education, due to the events and factors mentioned above, imply that the meta-evaluation processes to be carried out must have the following characteristics (International University of Valencia, 2025) :

- Particularity. This characteristic indicates that each educational institution must have an independent meta-evaluation process based on the results of its evaluation, avoiding the generalization of a meta-evaluation model for educational institutions of the same category or sector. Taking into account Ecuador's multiculturalism, as well as the diversity of ideologies, cultures, and beliefs, meta-evaluations cannot be generalized, much less comparisons made between peers.
- Objectivity. Meta-evaluation should focus on setting aside prejudices, political tendencies, biases, favoritism, or feelings toward an educational trend, management model, or individuals, in order to favor the use or disuse of synchronous or asynchronous study modalities. Ecuador is a country where these factors are very pronounced in all strata of

society, not to mention the education sector, so the objectivity of the team carrying out the meta-evaluation must prevail throughout the process.

- Simplicity. The aim is for the meta-evaluation process in Ecuador to be a simple process, without technicalities, but using logic and common sense to evaluate institutional measurement, the curriculum, and teachers, so that its results can be analyzed and understood qualitatively and quantitatively.
- Perfectible. The Ecuadorian meta-evaluation of these two modalities should not be rigid or strict, but rather subject to change during its execution due to the volatility of the social situation in Ecuador, as well as the particularities of each educational institution.
- Relevant. The meta-evaluation should be adjusted to verify the results obtained and ensure that they reflect the reality in Ecuador, since it may be the case that the meta-evaluation detects that the entire process measured is not relevant and does not offer results that can be analyzed both qualitatively and quantitatively.
- Constant feedback. Meta-evaluation for these two modes of synchronous and asynchronous study requires constant feedback in order to verify the data obtained in the short or medium term, so that effective improvement plans can be made that can provide immediate and planned solutions in the event that these modes are used temporarily or permanently in an Ecuadorian educational center.

Given the characteristics outlined above, it is suggested that, for the Ecuadorian system, the meta-evaluation of an educational institution should focus on the following aspects in general. Although it is not possible to generalize to an entire educational community, it is possible to have a general guide for carrying out a meta-evaluation effectively. These aspects are:

- Collegiate evaluation staff. These staff members should preferably not be part of the educational institution, and peers from other similar institutions or other educational levels may be used in order to verify the evaluation and avoid bias or subjectivity.
- Analyze the quantitative results obtained from the evaluation of the curriculum, teaching staff, and institution in terms of:
    - How the results were obtained. Analyze the methodology used to obtain the results, whether they were carried out in person or by telematic means. Verify the conditions prior to and during the execution of the evaluation, and whether or not an induction was given for its execution.
    - Time at which it was carried out. It should be analyzed whether sufficient time was allowed to carry out the evaluation, as well as whether it was carried out at the right time, i.e., at the end of an academic period, classes, semester, or time when the synchronous or asynchronous modality was carried out. Like any administrative or educational process, its execution without planning or in a hurried manner does not offer the expected results, since those evaluated do not offer the seriousness that a relevant process of this magnitude deserves.
    - Conditions under which the evaluation was carried out. The meta-evaluation must determine under what conditions the evaluation was carried out, since this defines its seriousness and determination to deliver the expected results. The reason for analyzing the conditions under which the evaluation was carried out establishes who carried it out, whether they were under any pressure to do so, whether they had the appropriate means to carry it out, whether there was adequate training, or whether the time frame for carrying it out was adequate.
    - Instruments used in accordance with the technological reality of the educational community. This premise determines whether or not the evaluation offers the expected results, since absenteeism or abstinence from it must be considered, as well as the pressures to carry out the evaluation for fear of retaliation, where at this point the necessary conviction for it to be a

transparent and transformative process for the benefit of the educational community has already been lost.

- Methodology in line with the numerical results obtained. Although the numerical results are accurate, the meta-evaluation must verify that the results shown are not obvious or that they do not show data that could be obtained in a simple manner or that was available to the institutional Statistics Department.

- Analyze the results obtained from the qualitative evaluation of the curriculum, teaching staff, and institution in the following areas:
  - Verify an index of the existence of meaningful learning quality in synchronous and asynchronous modalities. This index should be determined based on the tasks submitted in relation to the resources used online and their execution time. With this index, it is possible to assess the true retention of effective knowledge, showing whether tasks were only submitted to meet the schedule or whether meaningful learning was sought in the students.
  - Verify compliance with the General Teaching Plan in relation to the conceptual and pedagogical aspects of the student's course exit profile. This action, which will be non-numerical in synchronous and asynchronous modalities, can be compared with its face-to-face counterpart in order to verify the continuity of studies, as well as the fulfillment of the proposed objectives. This analysis must be comprehensive, verifying qualitative compliance using closed-ended questions that allow us to establish that there are no deviations in the curriculum, seeking its execution by verifying the existence of meaningful learning.
  - Define whether synchronous and asynchronous assessment was necessary, based on its use during the crisis. This constitutes the turning point that should make the difference in the meta-evaluation, since it is based on the conditions in which a national crisis was defined in Ecuador, in which the educational authorities ordered the use of asynchronous and synchronous modalities. it is here that it must be determined whether or not the institution was able to provide this modality, because not all households or families have the technological means or, depending on the crisis they are experiencing, were not in a position to receive classes, the reasons being forced displacement, lack of electricity, connectivity, etc. Consequently, this situation may arise, where it was not possible to provide this modality, yet it was taught and even evaluated on the basis of a non-existent or incomplete process.
  - Verify under what parameters, political, social, or internal institutional influence the evaluation of the synchronous and asynchronous modalities was designed and compare it with the face-to-face modality. This purely qualitative analysis factor must be determined as objectively as possible, since, as with the internal point, there may be a possibility that it was not necessary to use this modality or that the necessary conditions did not exist.
  - Verify the profile of the designers of the curriculum evaluation, the institution, and the teacher, emphasizing their participation in the institution, their professional relationship with administrators and teachers, and other information that may contribute to the design of the evaluation in the face-to-face, institutional, and curriculum modalities. This analysis is carried out in order to avoid biases or specific feelings that distort the reality of the evaluation data. This analysis must be confidential and must have the collaboration of the institution's administrators in order to provide adequate transparency to validate the meta-evaluation.

As can be seen, meta-evaluation can verify that learning in Ecuador in the current century is in line with the needs of the educational community and society in general. This procedure can be generalized at all levels in order to verify that the results obtained over a period of time are reliable and accurate, so that improvements can be made to raise the educational status of the entire Ecuadorian educational system.

Conclusions

As indicated, meta-evaluation is a process that allows for the verification of the suitability of the values obtained in the evaluation of the curriculum, the institution, and the teachers. The results of the meta-evaluation provide the certainty that allows for the attestation and testimony that study modalities such as synchronous and asynchronous learning are in line with the reality of Ecuadorian education, with the benefit of building knowledge in students.

Given that technology is a predominant factor in educational processes in the 21st century, synchronous and asynchronous study modalities are ideal for providing continuity to the educational process in a society such as Ecuador's, which is marked and affected by different events such as crime, drug trafficking and related crimes, power outages, unemployment, natural and anthropogenic events, which make it necessary to use both modalities. It is also necessary to verify the data obtained from the periodic evaluation of the curriculum, the institution, and the teacher, all of which are essential and basic elements.

The synchronous and asynchronous modalities per se have their own particularities, the effectiveness of which must be measured by means of a meta-evaluation carried out in an objective and technical manner, thus allowing for verification of the fulfillment of institutional and national objectives.

Consequently, the importance of meta-evaluation in verifying these two modalities lies in confirming that the evaluations carried out are accurate in their results regarding the establishment of knowledge, avoiding biases or data that do not correspond to the reality of the educational community. The students are directly affected by these variations in the short and medium term, and they must have solid knowledge to face the challenges of a globalized and competitive world such as the 21st century.

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Competitive analysis in the hotel sector associated with cotelco in the department of Santander

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Introduction

The economic and tourism growth of Santander, Colombia, has been driven mainly by the hotel sector. Santander has gained popularity as a top tourist destination in recent decades due to its cultural diversity, natural landscapes, and historical heritage. For this reason, it can be inferred that competitiveness in the hotel sector is crucial to maintaining and improving the region's position in the global tourism market. In addition, it should be noted that in Santander, as in the rest of the country, tourism and the hotel sector have gained relevance due to their relationship with other productive sectors, according to the overall results of the Colombian Regional Tourism Competitiveness Index (ICTRC), which evaluates eight criteria and assigns a rating using a scale of 0 to 10, placing Santander above the national average and below other reference departments, which went from having 10 to 18 municipalities in the sample, including the municipality of Bucaramanga (Rivera Martinez, 2022). This behavior has been analyzed by other authors who highlight how factors such as destination management, parafiscal returns, the inclusion of tourism in development plans, and tourism safety directly influence departmental competitiveness levels (Corzo and García-Méndez, 2020).

In this context, the hotels that are part of the Colombian Hotel and Tourism Association (COTELCO) play an essential role in improving the quality and competitiveness of the sector. Currently, in Santander, 55 hotels are affiliated with COTELCO, representing 3.84% of the total hotel supply in the region. These hotels range from small family inns to large luxury establishments. Membership provides these hotels with benefits such as operational, financial, and administrative training programs, joint promotion opportunities, and greater visibility in the market (Colombian Hotel and Tourism Association (COTELCO), 2022).

Despite the negative impacts on the sector as a result of the COVID-19 pandemic, several recovery strategies were implemented, such as biosafety protocols, the gradual reopening of tourist destinations with strict health safety measures, innovation and digitization with the use of technologies to improve the tourist experience and manage operations more efficiently, and the promotion of sustainable practices to create more resilient and responsible tourism (Caicedo Díaz, 2021).

Within a tourism context, competitiveness is measured from a cultural perspective, evaluating the management of the sector to be assessed. there are also environmental, social (identifying the training of employees in the provision of services, such as bilingual skills), economic (ability to meet international and national demand through financial statements, tax burden of the activity, among others), business (quality certificates for the provision of services), infrastructure, destination management, and market strategy (creation of tourist guides and use of virtual media to promote products) (Durán, 2020).

In turn, Peña (2023) identifies a model for analyzing national competitiveness using the competitiveness diamond, grouping four categories, among which the conditions of factors, demand, related sectors, and strategy, structure, and rivalry between companies stand out, obtaining information that allows

companies to improve service provision and increase customer acquisition, achieving a better position in the sector in which they operate.

This section presents the results obtained from the analysis of data from hotels affiliated with COTELCO in Santander, Colombia. The data was collected through surveys and interviews with managers of 42 hotels, focusing on key aspects such as the availability of a solid business team, the motivation and commitment of human resources, the adequacy of the organizational structure, the sufficiency of operating capital, and physical infrastructure. The results are divided into descriptive analysis and statistical analysis, providing a comprehensive view of the competitiveness of hotels in the region.

Resources and infrastructure

- Availability of a capable, creative, and entrepreneurial management team

The success of modern companies is based on the collaboration of talented individuals working toward common goals, requiring flexibility and responsiveness. The ability to perform various tasks within a unified team, backed by adequate training and experience, makes teamwork a source of competitive advantage (Cervantes et al., 2017). Regarding the availability of a solid and trained business team, the survey results indicate that 83.3% of the companies surveyed (35 responses) consider that they have a high-level team. On the other hand, 16.7% of companies (7 responses) rated this aspect as average, which can translate into a great stimulus for creativity, teamwork, and organizational development.

- Human Resource Motivation and Commitment

Business competitiveness depends on attracting and retaining exceptional talent. Management must foster commitment and motivation by providing tools and an appropriate environment. Careful selection, a positive work environment, and training are key to professional development and competitive attitudes (Pérez Vásquez, 2019). Furthermore, as stated by García-Méndez et al. (2021), knowledge management strengthens learning processes, value creation, innovation, and organizational performance, with human resources being an essential link in building sustainable competitive advantages in the hotel sector. In terms of motivation and commitment, the results show that 83.3% of companies (35 responses) perceive their human resources to be highly motivated and committed. Sixteen point seven percent of companies (7 responses) rated this factor at a medium level, indicating opportunities for improvement in commitment and professional development.

- Adequacy of the Organizational Structure

Organizational structure is crucial for business competitiveness, enabling efficiency and adaptation to change. Companies with an adequate structure stand out in the market. The six fundamental elements of this structure are job specialization, departmentalization, chain of command, span of control, centralization and decentralization, and formalization (Blanco Ariza, et al., 2019). In relation to organizational structure, 78.6% of the companies surveyed (33 responses) stated that they had an adequate structure at a high level, while 21.4% (9 responses) rated this aspect at a medium level, indicating opportunities to improve flexibility within the organization.

- Sufficiency of Capital for Operations

Accurate knowledge of resources and needs is crucial to improving business competitiveness. This requires financial analysis to assess solvency, indebtedness, and other metrics. Financial strategies support growth and the efficient allocation of resources, adapting to their actual availability (López Pacheco, 2022). The adequacy of capital for the company's operations was rated as high by 83.3% of respondents (35 responses) and as medium by 16.7% (7 responses), highlighting areas where financial management can be improved and the need to find strategies to overcome these limitations.

- Adequacy of Physical Infrastructure

Well-planned infrastructure is crucial for the development of the hotel sector, improving the quality of services and increasing competitiveness. Investments aligned with the hotel's objectives and the needs of domestic and foreign tourists are essential to attract more guests (Maeso et al., 2024). Finally, the physical infrastructure of the companies was considered adequate at a high level by 85.7% of respondents (36 responses), while 14.3% (6 responses) rated it at a medium level.

- Complementary Infrastructure

The hotel and tourism infrastructure sector is crucial for Colombia, standing out for its mega-diversity and unique attractions. It is essential that hotel facilities offer more than just accommodation, providing unique experiences in all regions of the country (Ventanilla unica de inversión, 2024). In terms of complementary infrastructure, 83% of companies (35 responses) believe they have the necessary infrastructure to meet the needs of tourists at a high level, while 14% (6 responses) rated it at a medium level, and 3% (1 response) said it did not apply, indicating the need to make improvements to these establishments in order to meet the expectations and needs of tourists.

Activities and processes

- Consistency of the Service Delivery Process with Organizational Objectives, Mission, and Vision

The design of service processes must be aligned with organizational objectives, ensuring that service activities support business strategies and contribute to goals. This alignment is crucial for evaluating the effectiveness of production in achieving objectives (González Benito, 2010). The survey results indicate that 93% of the companies surveyed (39 responses) believe that their service delivery processes are consistent with their organizational objectives, mission, and vision. On the other hand, 5% of companies (2 responses) rated this aspect as average and 2% (1 response) rated it as low, indicating that they need to work on improving the consistency between their service processes and their objectives in order to strengthen their competitiveness.

- Identification of Key and Support Processes in the Value Chain

Processes are essential for business efficiency. Their identification and management are key to continuous improvement, as not all of them have the same impact on customer satisfaction, strategy, corporate image, or staff well-being. It is useful to classify processes as key and support processes and manage them to build a system focused on continuous improvement (Aguilar Coto, 2013). The survey results indicate that 79% of the companies surveyed (33 responses) believe they have adequately identified the key and support processes that make up their value chain. On the other hand, 21% of companies (9 responses) rated this aspect at a medium level, highlighting areas for improvement to enhance competitiveness.

- Evaluation of Key and Support Process Performance in the Company

Detailed documentation of business processes is essential for standardizing and ensuring quality. It should clearly define the objective and scope of each process, specifying what to do, who will do it, when, where, and how, as well as the necessary materials, equipment, and documents. It should also include methods for monitoring and recording progress and contingencies. Standardized forms are used to maintain consistency throughout the organization (Guidelines for Quality Support in Local Public Management). The results indicate that 24% of the population surveyed is at an average level in this area and 2% at a low level, although 74% report a high level.

- Analysis of the Alignment of Service Supply with Demand and Market Trends

In a globalized market, organizations must adapt their services to changing demands and trends. Understanding customer needs allows them to identify opportunities and remain competitive. Demand-driven companies stand out for detecting the market and responding effectively (Day, 2013). The results show that 79% of the hotels surveyed have a high level of use of tools for this purpose, suggesting a good ability to respond to market dynamics. The remaining 21% show an average level of use, pointing to areas where adaptation to changing market demands needs to be improved, which could be crucial to maintaining competitiveness in such a dynamic environment.

- Innovation and development in services

Innovation is key to success in the competitive hotel sector. Innovation management allows companies to stand out and improve their services with new technologies and practices. This not only improves quality but also offers lasting competitive advantages. Hotels with innovative strategies achieve a better market position by adapting to changing demands and continuously improving their services (Rodney et al., 2021). The results obtained from the hotels surveyed show that 67% have a high level of promotion of development and innovation in services, indicating a strong focus on continuous improvement and adaptation to market demands. On the other hand, 33% of hotels have an average level of promotion of innovation, indicating that, although efforts are being made in this area, there is still room for significant improvement.

- Improvement actions based on customer needs and priorities

Today's customers demand high quality products and services. Understanding their needs and expectations is essential to improving the offering. Companies must maintain active communication, analyze feedback, and identify areas for improvement in order to tailor services to the real needs of customers (Castro Ávila & Rodríguez Torres, 2021). The results showed that 81% of hotels Respondents have a high level of understanding, indicating a strong ability to implement improvements based on this knowledge. However, 19% of hotels have a medium level, suggesting that there are still significant opportunities to improve their understanding and response to customer demands.

- Additional Benefits and Services Offered to Customers

Most customers value basic services such as cleanliness, security, and attention during their stay. However, their preferences change over time. It is crucial to understand the expectations of new customers in order to develop effective strategies (Castro et al., 2018). The results indicate that 48% of the hotels surveyed excel in the provision of complementary services. Thirty-three percent reported average levels of provision, suggesting areas for improvement and better adaptation to changing demands. In contrast, 14% showed a low level, indicating a possible need for further development in this area. Finally, 5% of the hotels surveyed do not provide complementary services

complementary services, which could mean a missed opportunity to attract and retain customers who value these additional benefits.

- Understanding how customers evaluate the services offered

Competition in today's market is intense and products are increasingly diverse, which has led consumers to become more demanding. They now seek not only quality and price, but also excellent customer service (Robayo Rodriguez, 2017). The survey revealed that 83% of the hotels surveyed are well informed about their customers' evaluations, while the remaining 17% show average knowledge of these evaluations, suggesting an opportunity to optimize the management of guest feedback.

- Continuous Evaluation for Customer Satisfaction Improvement and Market Penetration

Loyalty provides a competitive advantage. Therefore, companies must constantly evaluate themselves to identify areas for improvement. This involves collecting and analyzing customer feedback, renovating infrastructure, adopting innovative services, and training staff. By focusing on these factors, companies can differentiate themselves and ensure their growth in the market (Cedeño Mendoza & Real Pérez, 2020). The results show that 79% of respondents recognize that the company conducts constant evaluations. On the other hand, 19% perceive a medium level of evaluation, suggesting that there are areas where these efforts can be optimized and better communicated. Although only 2% perceive significant deficiencies, it is essential to address them to ensure a complete and effective evaluation within the organization.

Conclusions

The constant evolution of technologies and new demands in the tourism market require hotels to adapt quickly in order to remain competitive. The study shows that hotels affiliated with COTELCO in Santander have understood the importance of strengthening their operational, strategic, and technological capabilities to effectively respond to customer expectations. This adaptation is evident in investments in infrastructure, service innovation, and process adaptation, which are fundamental actions for offering differentiated experiences. The high perception of motivation and commitment among human resources also supports this transition, highlighting the role of talent in implementing improvements. However, gaps related to innovation and the provision of complementary services remain and must be addressed. Thus, digital transformation and customer focus are not only an operational necessity but also a central axis in building a sustainable competitive advantage in the hotel sector.

The competitive assessment carried out using the Inter-American Development Bank's tool clearly identified the current level of performance of COTELCO-affiliated hotels. Data collection and factor analysis revealed strategic patterns that highlight strengths in areas such as organizational coherence, staff motivation, and physical infrastructure adequacy, while also highlighting areas for improvement such as key process performance and in-depth knowledge of customer needs. This methodology provided participating hotels with a comprehensive view of their internal and external capabilities, allowing for the construction of a diagnostic basis for decision-making. Competitiveness cannot be managed intuitively; it must be supported by technical tools that guide strategic actions. In this sense, evaluation is not an end in itself, but rather the beginning of a process of continuous improvement that strengthens the sustainability and positioning of the hotel within the tourism market.

The analysis of resources, infrastructure, processes, service quality, and customer satisfaction demonstrated that a comprehensive view of the hotel business is essential to identify areas for improvement. It is not enough to have adequate infrastructure or motivated staff; these elements must be interconnected and aligned with the hotel's strategic objectives. Consistency between operational processes and the organizational mission, together with innovation and constant evaluation of the customer experience, strengthen business competitiveness. This systemic approach allows hotels not

only to detect their weaknesses, but also to establish priorities for action based on objective data. Continuous improvement should be understood as a permanent cycle, where strategic planning is built on operational reality and market trends. This working model fosters an organizational culture focused on quality, innovation, and sustainability, key elements for competing effectively in a changing environment.

Despite the progress made in various components of hotel management, the results also reveal persistent challenges that require immediate attention. Weaknesses in complementary services, innovation, performance evaluation, and alignment with market demand represent an opportunity to redefine strategies in the short and medium term. Sustainable competitiveness in the sector depends not only on financial indicators or occupancy levels, but also on the ability to anticipate changes and meet the expectations of increasingly demanding customers. The active participation of hotels in this assessment represents a commitment to improvement, which must be accompanied by training policies, investment in technology, and customer-oriented management practices. The study concludes that coordination between trade associations such as COTELCO, the public sector, and hotel entrepreneurs is essential to consolidate a solid, resilient tourism offering that is aligned with international trends in responsible tourism.

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Effect of resilience and entrepreneurial education in higher education on innovation

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Introduction

In recent years, entrepreneurial education in universities has become increasingly important in promoting the development of entrepreneurial skills in students by strengthening their knowledge, abilities, and attitudes toward entrepreneurship. Two fundamental variables stand out in this training process: resilience and innovation, which are key components for the success of university entrepreneurship. Resilience allows students to confidently face the challenges, uncertainty, and failures inherent in the business environment, while innovation gives them the ability to generate creative proposals and adapt to constant market changes (Ayala & Manzano, 2014). Within this framework, the present study focuses on analyzing how resilience, combined with innovation, significantly influences the promotion of entrepreneurial spirit in the university environment.

Resilience has been conceptualized as an adaptive process through which people are able to effectively face and overcome situations of risk and adversity (Masten & Obradović, 2006). In the context of entrepreneurial education, resilience is essential for overcoming the obstacles and challenges inherent in business processes.

University entrepreneurial education not only promotes the development of entrepreneurial skills, competencies, and intentions in students, but also acts as a catalyst for innovation by encouraging the generation of ideas and the adoption of decisions in scenarios of uncertainty. By providing tools that strengthen the ability to identify opportunities, face contingencies, and create value, this training contributes in a significant way to the development of resilient attitudes in the face of environmental challenges. In this way, the interaction between personal resilience and entrepreneurial education fosters a context conducive to university innovation (Rodríguez, 2023; Lemus et al., 2023; Gheno et al., 2023).

With its incorporation into the Sustainable Development Goals (SDGs), university education in entrepreneurship plays a key role in promoting student entrepreneurship. Studies indicate that the number of student businesses is positively affected by entrepreneurship education initiatives such as clubs, competitions, and business creation courses (Lee and Lee, 2024). The UN Sustainable Development Goals can also be achieved by including the SDGs in business courses, which can give students the opportunity to solve social and environmental challenges (Patricia, 2024).

Studies underscore the importance of entrepreneurship education in shaping students' intentions to start sustainable businesses and highlight the need to improve educational practices that are mindful of sustainability and the SDGs at the university level (Martínez and Peláez-Higuera, 2024).

In addition, the components of entrepreneurship education, such as the curriculum and university support, have a significant impact on entrepreneurial intent, highlighting the role of universities in contributing to the social fabric by creating jobs and contributing to economic growth (Vivekananth et al., 2023).

However, despite the recognized importance of educating university students from an entrepreneurial perspective, while also formulating strategies that foster an entrepreneurial spirit and promote the SDGs, there are still major challenges and gaps in their effective implementation. Strategies need to be explored to more effectively integrate sustainability principles, improve education on this topic, and raise awareness of development goals in university settings. To continue actively fostering students' entrepreneurial aspirations and their ability to address social and environmental issues, greater focus needs to be placed on curriculum development and support services.

Innovation is considered a core component of achieving sustained entrepreneurial success (Brem et al., 2016). In the context of higher entrepreneurial education, innovation encompasses the multiple ways in which a student can express themselves, aimed at generating creative ideas and transforming them into novel products or services that add value (Drucker, 1985; Porter, 1990).

This research seeks to elucidate the causal link between resilience, university entrepreneurial education, and innovation, as well as to examine the ways in which business education at the university level stimulates creativity and resilience. In addition, it will address the intersection between these three variables, highlighting their interrelationship and the impact they have on the development of basic skills committed to academic and professional pursuits in changing and challenging environments.

Resilience plays an essential role in the university business education process, as it has a favorable impact on students' entrepreneurial dispositions and attitudes, enabling them to face the challenges of their environment with greater determination and adaptability (Marliyah, 2023). This interaction between personal and educational factors is decisive in promoting innovative behavior in academic and professional settings. In order to deepen our understanding of these dynamics, this study uses SEM, a robust methodological tool that enables the investigation of intricate links between latent constructs such as resilience, university entrepreneurship education, and business innovation. This approach provides a comprehensive view of the theoretical and empirical components involved in the formation of entrepreneurial competencies (Kline, 2016), offering evidence on how these factors interact and mutually reinforce each other in educational contexts. Scientific evidence indicates that higher levels of resilience are associated with a greater perception of control over entrepreneurial intentions, and that attitude and subjective norms show significant positive relationships (Aguilar Cruz et al., 2022). Likewise, resilience acts as a mediator between self-efficacy and entrepreneurial intentions, as students with high levels of self-efficacy are more likely to have strong entrepreneurial intentions, especially when combined with higher levels of resilience (Abdel-Kader et al., 2023). Furthermore, entrepreneurial resilience is built through intrapersonal and exopersonal processes, shaping the strategic dimensions related to entrepreneurial behavior and helping university students build personal projects (Montoro-Fernández et al., 2022). This highlights the importance of promoting resilient strategies in students to improve their entrepreneurial mindset and their readiness to engage in entrepreneurial activities.

Resilience has an impact on entrepreneurial innovation by enabling founders to overcome challenges, adapt to uncertainties, and persist in pursuing their goals (Malathi & Karpagam, 2024). Entrepreneurial resilience encompasses cognitive, emotional, and behavioral dimensions, enabling entrepreneurs to recover from failures, solve problems creatively, and remain motivated in the face of adversity. Strategies such as DIY, improvisation, open innovation, and learning from failure are activated to enhance resilience and stimulate innovation in entrepreneurial ecosystems (Mafimisebi et al., 2024).

Resilient entrepreneurs display higher levels of adaptability, persistence, and creative thinking, positioning them for long-term success in dynamic market environments (Dewi, 2024). By cultivating

resilience skills, fostering innovation, and supporting access to capital and entrepreneurial education, policymakers can build a resilient ecosystem that drives economic prosperity and sustainability through entrepreneurial initiatives (Khuan, 2024).

The present study aims to determine the causal relationship between resilience and university entrepreneurship education, and their combined effect on innovation. To this end, an explanatory quantitative approach is used, employing SEM, which allows for the simultaneous analysis of direct and indirect relationships between latent variables. This methodology facilitates a comprehensive understanding of how individual capacities (resilience) and formative factors (entrepreneurial education) significantly influence the generation of innovative behaviors and competencies in university contexts.

This section presents the findings derived from the examination of the structural model, applying the SEM technique with PLS-SEM. The estimated path coefficients (**β**) for each hypothesized link between the latent constructs are reported, as well as the statistical significance values (p), the corresponding confidence intervals, and the associated t-statistics. This analysis makes it possible to unravel the intensity, orientation, and statistical relevance of the effects established between resilience, university entrepreneurial education, and innovation.

Structural model

Table 1 shows the estimated path coefficients (**β**) for the links postulated in the structural model. These coefficients represent the intensity and directionality of the relationships between the latent constructs. All coefficients were statistically significant at the 0.05 level, as evidenced by the p = 0.000 values. In particular, resilience has a positive and robust effect on both entrepreneurship (**β** = 0.854) and innovation (**β** = 0.534). Likewise, entrepreneurship has a positive and significant effect on innovation (**β** = 0.426).

Table 1. *Path coefficients (β)*

Proposed effects	Original sample (O)	Mean (M)	S.D. (STDEV)	Statistics t	Confidence intervals		p-values
					2.50%	97.50%	
ENTREPRENEURSHIP -> INNOVATION	0.426	0.426	0.117	3.63	0.202	0.668	0.000
RESILIENCE -> ENTREPRENEURIAL	0.854	0.855	0.035	24,402	0.782	0.917	0.000
RESILIENCE -> INNOVATION	0.534	0.532	0.117	4.545	0.283	0.748	0.000

Note: The estimated coefficients for the proposed relationships are described.

Table 2 shows the direct, indirect, and total effects of the latent variables in the structural model. The direct effects correspond to the trajectory coefficients previously reported in Table 1. Additionally, the specific indirect effect of resilience on innovation through entrepreneurship (**β** = 0.364) is presented, which was statistically significant at the 0.05 level (p-value = 0.001).

Table 2. *Total direct and indirect effects*

Proposed effects	Total direct effects				
	Original sample (O)	Mean (M)	S.D. (STDEV)	Statistics t	p-values
ENTREPRENEURSHIP -> INNOVATION	0.426	0.426	0.117	3.630	0.000
RESILIENCE -> ENTREPRENEURIAL	0.854	0.855	0.035	24,402	0.000
RESILIENCE -> INNOVATION	0.898	0.897	0.029	30.544	0.000
	Specific indirect effects				
RESILIENCE -> ENTREPRENEURSHIP -> INNOVATION	0.364	0.365	0.105	3.467	0.001

Note: The direct and indirect effects of the variables are described as " ."

Table 3 shows the correlations and covariances between the latent variables in the model. All latent variables are positively correlated with each other, with correlation coefficients ranging from 0.854 to 0.898.

Table 3. *Correlations and Covariances*

Variables	Correlations			Covariances		
	ENTREPRENEURIAL	INNOVATION	RESILIENCE	ENTREPRENEURIAL	INNOVATION	RESILIENCE
ENTREPRENEURIAL	1,000	0.882	0.854	1,000	0.882	0.854
INNOVATION	0.882	1,000	0.898	0.882	1.000	0.898
RESILIENCE	0.854	0.898	1,000	0.854	0.898	1.000

Note: Correlations and covariances are described.

The SEM that examines the interrelationships between resilience, entrepreneurial education, and innovation. There is a direct and positive effect of resilience on entrepreneurial education, with a coefficient of 0.854, as well as a direct and positive effect of entrepreneurial education on innovation, with a coefficient of 0.426. Similarly, resilience has an indirect effect on innovation through the mediation of entrepreneurial education, as evidenced by the product of the path coefficients (0.854 × 0.426 = 0.364). The latent variables are measured by several observed indicators (p1 to p18), and the numbers next to the arrows pointing from the latent variables to the observed indicators represent the factor loadings. In addition, there is a positive indirect effect of resilience on innovation through entrepreneurial education. These findings suggest that resilience has a positive influence on entrepreneurial education, which, in turn, fosters innovation, and that resilience also indirectly impacts innovation through its effect on entrepreneurial education.

Table 4 presents information regarding the reliability and validity of the latent constructs of the model. The Cronbach's alpha and composite reliability (**ρ**c) values exceed the threshold of 0.70 for all variables, indicating satisfactory internal consistency. Likewise, the average extracted variance (AVE) values exceed the recommended cutoff point of 0.50, confirming the presence of adequate convergent validity.

Table 4 *Reliability and construct validity*

Variables	Cronbach's alpha	Compound reliability (rho_a)	Compound reliability (rho_c)	Average extracted variance (AVE)	R^2	R^2 adjusted
ENTREPRENEURIAL	0.893	0.898	0.894	0.586	0.730	0.729
INNOVATION	0.907	0.909	0.908	0.622	0.855	0.853
RESILIENCE	0.884	0.885	0.883	0.558	-	-

Note: The reliability and validity of the variables are described.

Table 5 describes the variance inflation factors (VIF) for the latent variable indicators. All VIF values are less than 5, suggesting that there are no serious collinearity problems among the indicators.

Table 5 *External collinearity statistics (VIF)*

External model - List	VIF
p1	1.885
p10	2.866
p11	2,507
p12	2,023
p13	1,927
p14	1,866
p15	3,936
p16	3,529
p17	2,443
p18	1,748
p2	2,343
p3	1,835
p4	2,042
p5	2,105
p6	2,018
p7	2,316
p8	2,634
p9	2,541

Note: Description of variance inflation factors.

Table 6 shows the VIF values for the latent variables in the internal model, as well as the f-squared values. The VIF values are less than 5, indicating the absence of collinearity problems. The f-squared values indicate the size of the effect of one latent variable on another, with the effects of resilience on entrepreneurship and innovation being greater than the effect of entrepreneurship on innovation.

Table 6 *Internal collinearity statistics (VIF) and f-squared*

Internal model - List	VIF	f^2
ENTREPRENEURSHIP -> INNOVATION	3.704	0.336
RESILIENCE -> ENTREPRENEURIAL	1,000	2,704
RESILIENCE -> INNOVATION	3,704	0.529

Note: The VIF values for the latent variables in the internal model are shown, as well as the f-squared values.

Table 7 provides several model fit indices for both the saturated model and the estimated model. The SRMR value of 0.043 indicates a good model fit. However, more information about the evaluation criteria used would be needed to properly interpret the other fit indices.

Table 7 *Summary of model fit indices*

Fit indices	Saturated model	Estimated model
SRMR	0.043	0.043
d_ULS	0.313	0.313
d_G	0.339	0.339
Chi-square	347.280	347.280
NFI	0.876	0.876

Note: The model fit indices are shown.

Table 8 presents the criteria for evaluating the discriminant validity of the model. HTMT values (Heterotrait-Monotrait ratios) below 0.9 suggest adequate discriminant validity.

Table 8. *List of Heterotrait-Monotrait (HTMT) ratios*

	Heterotrait-Monotrait ratio (HTMT)
INNOVATION <-> ENTREPRENEURIAL	0.885
RESILIENCE <-> ENTREPRENEURIAL	0.851
RESILIENCE <-> INNOVATION	0.897

Note: The criteria for evaluating the discriminant validity of the model are presented.

In Table 9, according to the Fornell-Larcker criterion, the square roots of the AVE values (on the main diagonal) are greater than the correlations between the latent variables, which also indicates good discriminant validity.

Table 9. *Fornell-Larcker criterion*

	ENTREPRENEURIAL	INNOVATION	RESILIENCE
ENTREPRENEURIAL	0.766		
INNOVATION	0.882	0.788	
RESILIENCE	0.854	0.898	0.747

Note: The Fornell-Larcker criterion is presented, the square roots of the AVE values

Table 10 summarizes the results of the hypotheses proposed in the study. All hypotheses (H1, H2, H3, and H4) are supported by the data, since the confidence intervals of the path coefficients do not include zero and the p-values are less than 0.05.

Table 10. *Summary of path coefficient findings*

Hypothesis		Confidence intervals		Path coefficient (β)	p-values
		2.50	97.50%		
H1	ENTREPRENEURSHIP -> INNOVATION	0.025	0.975	0.426	0.000
H2	RESILIENCE -> ENTREPRENEURIAL	0.202	0.668	0.854	0.00
H3	RESILIENCE -> INNOVATION	0.782	0.917	0.534	0.000
H4	RESILIENCE -> ENTREPRENEURSHIP -> INNOVATION	0.283	0.748	0.364	0.000

Note: The hypotheses were tested at a 95% significance level.

Table 10 shows that all the hypotheses proposed in the structural model are statistically significant and positive ($p < 0.05$), indicating that there is a causal relationship between resilience, university entrepreneurial education, and innovation. In the context of the PLS-SEM approach, the model is considered to be a good fit when the relationships are significant, the explained variance (R^2) is adequate, and there is predictive power (Q^2). In this study, the results support both the direct effects and the mediating effect of entrepreneurial education between resilience and innovation.

Furthermore, this study confirms the cardinal role that university entrepreneurial education plays in the development of entrepreneurial skills, competencies, and intentions, which directly influences the strengthening of an innovative mindset in students. The results of the structural framework show that entrepreneurial education has a favorable and significant influence on innovation ($\boldsymbol{\beta} = 0.426$; $p < 0.000$), which empirically supports this relationship. This finding coincides with that reported by Rodrigues (2023), who argues that university environments that promote entrepreneurship produce students who are more willing to propose creative solutions to complex problems. Similarly, Lemus et al. (2023) argue that entrepreneurial training programs enhance divergent thinking, decision-making in uncertain contexts, and proactive leadership, which are key competencies for innovation. Gheno et al. (2023) also point out that active participation in activities such as incubators, project fairs, and innovation competitions raises levels of self-efficacy and entrepreneurial motivation among students, facilitating the development of transformative ideas with an impact on their communities. Taken together, this evidence suggests that university entrepreneurship education not only drives business creation but also plays a fundamental role in training young innovators with high adaptive capacity and strategic vision.

The results obtained highlight the critical importance of resilience and university entrepreneurship education as determining factors in promoting innovation within the academic context. This importance stems from the fact that both variables not only directly influence students' ability to generate new ideas, but also strengthen their skills to implement them effectively in complex and uncertain scenarios. Resilience, in particular, enables future entrepreneurs to face adversity, overcome failure, and adapt to changing environments, which are essential characteristics in sustained innovation processes. Several studies support this finding: Malathi and Karpagam (2024) highlight that resilience is a key predictor of innovative entrepreneurial behavior; Mafimisebi et al. (2024) show that resilient individuals have greater risk tolerance and greater persistence in executing novel ideas; and Dewi (2024) points out that resilience acts as a psychological driver of creativity in the face of uncertainty. Therefore, it is concluded that without a solid foundation of resilience, even the best entrepreneurial training strategies may be limited in their ability to generate real and sustained innovation. A significant finding of this research is the direct beneficial impact of resilience on university business education. This suggests that students with higher levels of resilience are better prepared to take advantage of entrepreneurship programs and develop their business skills more effectively. These results are consistent with previous studies showing a favorable link between resilience and entrepreneurial dispositions and attitudes (Marliyah, 2023; Aguilar Cruz et al., 2022; Abdel-Kader et al., 2023). Resilient students have a greater perception of control over their entrepreneurial intentions and exhibit more favorable attitudes and subjective norms toward entrepreneurship.

Another important finding is the indirect effect of resilience on innovation through university entrepreneurial education. This implies that resilience not only directly impacts innovation but also has an effect mediated by entrepreneurship programs and activities at universities. Resilient students are better prepared to take advantage of entrepreneurial education, which in turn allows them to develop innovative and creative skills more robustly. This indirect relationship highlights the importance of promoting strategies that develop resilience in entrepreneurial education programs to maximize their impact on innovation.

In conclusion, the results achieved allow us to conclude that there is a significant causal relationship between resilience, university entrepreneurial education, and innovation, thus fulfilling the main

objective of the study: to determine how resilience and entrepreneurial education influence innovation among university students. Specifically, it is confirmed that resilience has a direct and positive effect on both entrepreneurial education (**β** = 0.854) and innovation (**β** = 0.534), and also exerts an indirect effect mediated by university entrepreneurial education (**β** = 0.364), empirically supporting the hypotheses proposed. These findings are consistent with previous research (Malathi & Karpagam, 2024; Marliyah, 2023; Rodrigues, 2023), which shows that resilience is a key factor in facing the challenges of entrepreneurship, while university entrepreneurial training promotes the development of innovative and creative skills.

In this sense, the crucial importance of integrating the development of resilience as a strategic component within university entrepreneurial education programs is reaffirmed. This integration not only contributes to the strengthening of entrepreneurial skills, but also allows for the training of students with greater adaptive capacity, persistence in the face of failure, and a mindset oriented toward creative problem solving. In an increasingly dynamic, competitive, and uncertain business environment, these skills are essential for achieving sustained innovation and professional success.

Therefore, it is strongly recommended that universities design and implement specific pedagogical strategies to foster student resilience, such as the use of active methodologies, simulations of adverse situations, mentoring with real entrepreneurs, and spaces for emotional reflection. Only in this way will it be possible to achieve a comprehensive education that combines technical knowledge, soft skills, and psychological abilities geared toward innovative entrepreneurship.

In addition, it is essential that universities continue to strengthen and expand their entrepreneurial education programs, providing students with practical opportunities and hands-on experiences to develop their entrepreneurial and innovative skills. This may include the creation of business incubators, mentoring programs, business plan competitions, and collaborations with local businesses and business organizations. This study highlights the synergy between resilience, university entrepreneurial education, and innovation, and provides a solid foundation for higher education institutions to design and implement comprehensive programs that address these three aspects holistically, thus preparing students to become promoters of change and innovation in the global business landscape. The study's limitations include sample size restrictions and its quantitative approach; however, its findings have practical implications by proposing the inclusion of training strategies that strengthen resilience and innovation in entrepreneurial education, and it also recommends future research with comparative approaches and mixed methodologies.

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Dynamics of inequality and emotional ambiguity among ‘chicas' and 'señoras' working as domestic workers in Mexico City

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Introduction

Paid domestic work is defined by its structurally subordinate character within the social order, and by the inequalities of gender, class, and ethnicity that keep it on the margins of economic, legal, and symbolic recognition (Ariza, 2024a; Durin, 2017; Hill Collins & Bilge, 2019). Despite its essential role in the organization of everyday household life, this sector remains undervalued and highly feminized. It is further characterized by high levels of informality, limited labour protections, and persistent institutional invisibility.

According to data from Mexico’s 2020 Population and Housing Census, conducted by the National Institute of Statistics and Geography (INEGI, for its initials in Spanish), domestic work has declined in terms of the number of workers. Beyond its material conditions, it also constitutes a space where affective, economic, and power dynamics converge. These characteristics create a fertile ground for emotional ambiguity (Ariza, 2024b; Gorban, 2012), in which domestic workers are exposed to situations in which they must manage expectations of deference, affection, and availability, while confronting hierarchical relationships and structures that constrain their autonomy. In this context, emotions are not merely present in daily labour; they operate as instruments of social control and mechanisms for reproducing inequality (Kemper, 2006; Scheff, 1988). The construction of pseudo-familial bonds –combining symbolic closeness with structural distance– reinforces this ambiguity (Canevaro, 2020; Rollins, 1985).

This paper analyses emotional ambiguity through the lens of the concept of sociological ambivalence (Merton, 1980), aiming to understand how emotions mediate and obscure unequal labour relations. Specifically, it examines the tension between gratitude and resentment as a central analytical axis. By comparing the trajectories of younger and older women –referred to as “girls” (chicas) and “ladies” (señoras)– the study explores the distinct ways in which each group, according to their generational positions and their labour trajectories, as elements of distinction, manages subordination, affective dependency, and symbolic recognition (Brites, 2014; Durin, 2017; Gorbán et al., 2014).

The concept of sociological ambivalence, as developed by Merton and Barber (1980), refers to the coexistence of contradictory normative expectations associated with a single social role. This ambivalence reveals the structural tensions that individuals must navigate in everyday practice. While the original formulation has been critiqued for its static and overly structuralist orientation, later revisions have reconceptualized ambivalence as a situated process of negotiation, shaped by power relations and social asymmetries (Hillcoat-Nallétamby & Phillips, 2011).

Building on this framework, the notion of emotional ambiguity is proposed as a subjective –though structurally configured– dimension of sociological ambivalence. It emerges in situations in which labour and emotion are intertwined, particularly under hierarchical power dynamics, and manifests as a difficulty in identifying, naming, or categorizing one’s own emotional responses. In the case of

domestic work, this concept helps illuminate how emotions such as gratitude, resentment, and loyalty can coexist in contradictory ways, often remaining unspoken or illegible (Brites, 2007; Gorban, 2012).

To understand how such contradictory emotions are not only felt but also learned, embodied, and reproduced, the concept of *emotional habitus* becomes essential (Burkitt, 1997; Gould, 2009). Emotional habitus refers to socially constructed emotional dispositions that guide, often unconsciously, what to feel, how to feel it, and how to express it within a specific social group.

From this perspective, emotions are defined as embodied practices and shaped by power, culture and experience, not only as internal or psychological states. In the context of domestic work, emotional habitus is formed through socialization processes that legitimize deference, self-restraint, and gratitude as appropriate responses even in the face of structural inequality.

Empirical research has shown that these emotional tensions are particularly acute in contexts of pseudo-familiarity (Canevaro, 2020), where symbolic recognition is not accompanied by improvements in material working conditions. Rollins (1985), for instance, demonstrated how the emotional labour demanded of domestic workers can serve as a form of control, veiled in maternalistic discourse. In Latin America, Brites (2007) describes what she calls a "didactics of social distance," whereby employers cultivate symbolic closeness that ultimately reinforces hierarchies without challenging the structural conditions of subordination. Similarly, Gorban (2012) highlights how, in the absence of explicit affective rules, domestic workers must interpret and respond to unspoken expectations, conveyed through ambiguous gestures or silence, thereby placing strain on their emotional autonomy.

From this approach, emotional ambiguity is understood as a situated social experience in which structural inequalities are both reproduced and, at times, contested. It provides a conceptual framework to examine how domestic workers –both younger and older– navigate affective dilemmas that simultaneously express and sustain inequality: between the desire for recognition and the experience of precarity, between expected obedience and the impulse to resist.

The analysis of domestic workers' emotional experiences reveals the complexity of their labour relationships, which are shaped by emotional ambiguities and tensions. We focus on the ambivalence between gratitude and resentment. This lens allows for an examination of how emotions operate as mediators in the reproduction of hierarchies and structural inequalities, and at the same time how they are configured by this reproduction.

Both younger and older domestic workers are embedded in a system of emotional deference that shapes behavioural expectations and power relations (Scheff, 1988). For younger workers, this deference is expressed through the need to display obedience and gratitude, particularly due to their connection with the occupational support centre, which mediates their hiring. This generates a tension between complying with employers' demands and meeting the institution's expectations, to avoid jeopardizing their employment and maintain the centre's support.

Emotional ambiguity emerges from the coexistence of gratitude for employment and the need to accept conditions that may be unfair or abusive. These workers are expected to demonstrate efficiency, politeness, respect, and a particular emotional disposition, which reinforces their subordination. Edith arrived at the occupational support centre at 14, hoping to complete high school and gain independence. However, due to her age and inexperience, she found it difficult to secure a job. In her first placement, she felt gratitude toward her employer, whom she described as a "good person," but also recounted that the household was extremely disorganized and that she was asked to clean quickly using large amounts of bleach, which "damaged her hands." In this position, Edith experienced symbolic mistreatment:

She [the employer] came by bike, and I had to go on foot. Then she'd take off on the bike and… she'd tell me to run, and I don't know… and I'd say, 'No, I can't run,' and I was scared to cross the street […] I had to go, yeah, following her, and I don't know, I didn't really like that part.

After several months on the job, the cumulative physical and emotional strain led to a growing sense of distress and frustration. At first, Edith felt unable to express her discomfort, fearing retaliation not only from her employer but also from the occupational support centre. Eventually, however, she confronted her employer directly:

Well, I wanted to talk back to her, but no, no, I couldn't. But toward the end, during the last two months, I admit it, I did talk back. I'd tell her, 'It's just that you're on the bike,' honestly, 'I get tired, I can't run. I'm scared to cross the street.' Yeah… I did answer her.

Edith's emotional ambiguity reveals a tension between gratitude for having secured her first job and the imperative to protect her personal well-being. This tension surfaces in her efforts to meet expectations at work, while simultaneously beginning to challenge her employer's behaviour –such as snapping her fingers when Edith could not keep up with her pace on the bicycle– and to question the fairness of her compensation: $300 per day, a wage below the average for the workload involved. Initially, Edith exhibited deference (Scheff, 1988) and made efforts to adapt to what was expected of her. Over time, however, she began to express her discomfort, navigating the contradiction between enduring abusive conditions, her desire to resist, and her reluctance to disappoint the staff at the support centre.

Older domestic workers experience emotional deference in ways that differ significantly from their younger counterparts. Their relationships with employers are often structured by long-term labour arrangements underpinned by a form of maternalism that elicits loyalty and compliance, even in the presence of subtle humiliation or symbolic erasure (Rollins, 1985). Lacking institutional support networks, these workers face greater risks when considering a change of employment, which often suppresses resentment and redirects it into resignation or cynicism. Their emotional experience is marked by the coexistence of pride and sacrifice, especially when affective recognition fails to bring material improvement. This dynamic is evident in the case of Amelia, who has worked in domestic service for 39 years and lives two very different realities depending on the household. In one, she experiences a veiled subordination; in the other, she feels valued and respected:

I have other employers that I care about a lot, and I know they really appreciate me too. I've been working with them for 20 years, and from the moment I started, it's always been respectful. Like, 'What are we having for lunch?', we sit down and eat together. 'What are we having for breakfast?', we have breakfast together. They even leave me money to buy the groceries […] Yeah, with that couple, we've always gotten along really well, no disrespect, not from them and not from me either. And it's nice, you know, when we have coffee together and chat and laugh.

Unlike many domestic workers, Amelia describes a relationship with her employers marked by mutual respect and familiarity, where her efforts are both valued and recognized: ·This is the place where I feel like, yes, my work is actually paid for. I feel satisfied that I ended up with this family, and yeah… nothing like the other one·.

By contrast, in her other job, Amelia finds herself in a more distant and hierarchical relationship, which reveals a subtler form of humiliation and inequality:

With this family, I always feel like I'm smaller than them, you know? I've always told them, 'Well, it's your money, right? It's because of your money that you are who you are.' And, well, someone like me, with no education, no money, well, I'm down here.

Amelia acknowledges the asymmetry of power-shaped by differences in economic status and educational background, as a key factor influencing how her work is perceived and how she interacts with her employers. Yet her response to this imbalance is one of resignation, accompanied by a quiet hope for something different in the future:

In the end, I also tell myself, you know, this is temporary. One day I'll say, 'Alright, I'm out.' And then I'll go rest or, well, keep on with the battle at home. But at least there, things kind of balance out.

The concept of emotional habitus (Burkitt, 1997; Gould, 2009) offers a useful lens for understanding how expectations of obedience and submission are internalized differently across groups. For younger domestic workers, being situated in a context that promotes education and provides pathways for upward mobility fosters a habitus that blends deference with aspirations for advancement. However, this dynamic also produces emotional ambiguity when the normative expectations of domestic work, which demand gratitude and subordination, come into conflict with their desire to progress and to be recognized as agents of their own lives. This tension is illustrated by Maricruz, who has completed her undergraduate degree and plans to begin a master's program:

I had to quit a job because of school. I was enrolled in a weekend university program, and the employer was like, 'I need you to come in on Saturdays.' And I said, 'Well, I can't,' like, 'I just can't.' And she told me, 'Sometimes school can wait, you know? You could pause school; just work for the few months, I need you', like three or four months, and then go back to school. At first, I thought, 'Yeah, maybe, I guess,' but then I said, 'No. I mean, why should I put someone else's needs before my own dreams, before what I want?' So, I said, 'You know what? Thank you very much. There will be other jobs, and… no.

Maricruz exemplifies how the pursuit of personal advancement and the need to protect her physical and emotional well-being can come into conflict with the demands imposed by her employers. The importance she places on safeguarding her integrity is evident in the decision she makes:

Like, it was always like… and also because I feel like [name of the person from the support centre omitted] has always been like, 'your physical and emotional well-being comes before any job.' So yeah, I think that was the moment when I really said, 'It's now, or this is going to go to another level.' So, I said, 'You know what? I quit.

In this instance, Maricruz exercises her personal agency by prioritizing her well-being and education over the demands of her job. Her experience illustrates how emotional ambiguity becomes a persistent challenge for young domestic workers, who must navigate the tension between expected gratitude and subordination on the one hand, and their own aspirations and need for autonomy on the other.

In the case of older domestic workers, emotional habitus is shaped by long histories of service, where norms of sociability emphasize maintaining harmony and concealing discomfort. Over the years, these workers have internalized the notion that their role requires subordination and gratitude, which in turn compels them to suppress negative emotions. Yet emotional ambiguity becomes apparent when, despite conforming to expected deference, they experience resentment at being undervalued or disregarded in terms of their labour rights. Returning to Amelia's case, we observe how this emotional ambiguity is articulated in her account of her relationship with one of her employers:

And another day, I don't remember what happened, but she said, 'Just so you know, whether it's you or Maura [her coworker] I'll fire you both.' So, I turned around and said, 'You just tell me when. Tell me when.' She turned around and walked away, because yeah, if she had told me right then, I would've grabbed my scooter and left. But she just said, 'I'll let you know.' And I was like, 'Yeah, sure, you tell me when'.

In these words, Amelia conveys a contained sense of frustration and fatigue, where her willingness to leave the job emerges as a subtle form of resistance. Though she avoids direct confrontation, her firm response "just tell me when" reveals a quiet assertion of dignity, laced with a hint of sarcasm. It is a way of pushing back without fully transgressing the norms of obedience that govern the labour relationship: "And there are times when I do feel like I'm walking a tightrope, even though… well. And I've told them. I just want her to tell me: 'You're fired.'" This excerpt highlights the emotional vulnerability of older domestic workers who, despite long-term relationships with employers, remain in a state of uncertainty, subject to their employers' will. Emotional ambiguity emerges from the need to keep working despite the resentment built up from being treated as disposable and denied full recognition for years of service.

In both groups, the habitus of submission and the expectation to display gratitude function as mechanisms reinforcing structural inequality, though with distinct nuances: among younger workers, there is greater openness to emotional resistance, whereas among older workers, resignation tends to prevail. In domestic labour, emotional ambiguity stems from the pressure to display gratitude and deference while internally feeling resentment over the lack of recognition. Drawing on Scheff's (1988) framework, emotions like resentment and shame function as mechanisms of control, reinforcing submission and silence. This tension traps domestic workers in unequal relationships, where expressing injustice risks job loss or being labelled ungrateful.

Conclusions

The analysis of the experiences of "*chicas*" and "*señoras*" working in domestic service in Mexico City reveals that emotional ambiguity –particularly the tension between gratitude and resentment– is a structural component of their labour conditions. The emotions they experience operate as mechanisms through which inequalities of class, gender, and age are reproduced and managed. Among younger workers, gratitude toward both employers and the institution that facilitates their labour insertion coexists with a desire for autonomy. This ambivalence emerges in the form of ethical and emotional dilemmas, especially when they must choose between conforming to the (emotional) expectations of the job or prioritizing their personal integrity and life projects. For older workers, emotions take shape within long-standing employment relationships and in the absence of institutional support networks capable of buffering their subordination. Pride in their demonstrated loyalty and in the symbolic recognition they receive is interwoven with resignation or fatigue in the face of the fact that they do not receive a dignified treatment as persons and as workers. Their emotional agency is expressed more through restraint than confrontation. In both cases, emotional ambiguity is not a side effect of domestic work, but a constitutive dimension that enables the maintenance of functional relationships, even at the cost of personal well-being. Attending to this emotional dimension of structural inequality is essential for understanding subordination beyond its material aspects, and for envisioning policies address labour conditions from the relational frameworks that sustain them.

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Evolution and Scientific Structure of Purchase Intention: A Bibliometric Analysis from an Interdisciplinary Perspective

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Introduction

In recent decades, purchase intention (PI) has emerged as one of the most studied variables in consumer behavior, particularly within digital and sustainable contexts. This construct not only predicts purchasing behavior but also integrates cognitive, affective, and social influences. Studies such as Paul *et al.* (2016), Hamzah and Tanwir (2021), and Ahmad and Zhang (2020) highlight the effectiveness of the extended Theory of Planned Behavior (TPB) when incorporating environmental concerns. Likewise, Prakash and Pathak (2017), Rausch and Kopplin (2021), and He *et al.* (2018) confirm its value by considering environmental awareness and responsible attitudes.

The influence of social media on the formation of purchase preferences represents a key trend in the study of purchase intention (PI). Alalwan (2018) and Shan et al. (2020) demonstrate that platforms like Facebook and Instagram not only disseminate information but also create symbolic connections between users and influencers, significantly impacting PI. Huang and Ge (2019), Chou *et al.* (2024), and Lin *et al.* (2011) emphasize the persuasive role of blogs, where source credibility and content trust are critical. Thus, parasocial interaction and social influence emerge as essential dimensions (Sokolova & Kefi, 2020; Masuda *et al.*, 2022; Vahdat *et al.*, 2021).

From a technological and ecological perspective, PI has been examined in contexts of responsible innovation. Confente et al. (2020), Hsu and Lin (2015), and Filieri et al. (2018) analyze the acceptance of bioplastics, highlighting the role of sustainability knowledge, perceived usefulness, and personal beliefs. On the other hand, Persaud and Azhar (2012), Martins et al. (2019), Qalati et al. (2021), and Kim and Lennon (2013) explore smartphone adoption, where attitudes toward usefulness, ease of use, and perceived risk shape PI (Hong & Cha, 2013; Wang et al., 2013).

An emerging line of research links PI with corporate social responsibility (CSR) and ethical marketing. Ramesh et al. (2019), Lee and Shin (2010), y Elving (2013) demonstrate that the perception of responsible business practices influences purchasing decisions, particularly in contexts sensitive to transparency. Simultaneously, Dash et al. (2021) and Peng et al. (2019) emphasize relationship marketing, where trust, emotional commitment, and brand reputation (Bian & Forsythe, 2012; Aziz & Chok, 2013; Huang et al., 2010) serve as key strategic factors.

Review of theoretical models

According to Hsu and Lin (2015), purchase intention (PI) is defined as the user's willingness to pay for mobile applications after using free versions, reflecting a post-adoption attitude influenced by prior experience and perceived value. Based on an extension of the Expectation Confirmation Model (ECM), PI integrates both rational and affective evaluations focused on product utility and satisfaction. The model includes four dimensions of perceived value—performance, emotional, social, and monetary—

which together provide a comprehensive explanation of the motivations driving users to complete digital purchases in contexts dominated by intangible services.

In the study by Paul et al. (2016), PI is conceptualized as the consumer's willingness to purchase green products, serving as a precursor to pro-environmental behavior. Based on the Theory of Planned Behavior (TPB), the model incorporates environmental concern as an additional variable that influences PI both directly and indirectly. Four dimensions are identified: attitude toward the behavior, subjective norm, perceived behavioral control, and environmental concern. These dimensions help explain how personal and social factors shape the intention to engage in environmentally conscious consumption.

According to Rana and Paul (2017), PI for organic food is defined as the consumer's willingness, shaped by a cognitive-affective process that integrates attitudes, beliefs, and personal values. As a precursor to actual consumption, this construct acts as a predictor of responsible behavior. The theoretical model identifies seven key dimensions: health consciousness, perceived quality and safety, environmental concern, willingness to pay premium prices, certification and labeling, lifestyle, and social awareness. These dimensions shape a consumer profile that is conscious, ethically motivated, and committed to personal and environmental well-being, offering a comprehensive approach to understanding PI in sustainable contexts.

According to Sokolova and Kefi (2020), PI refers to the consumer's willingness to acquire products promoted by influencers on social media platforms such as YouTube and Instagram. This planned behavior is influenced by affective and cognitive factors derived from interactions with digital content. The theoretical model integrates the elaboration likelihood approach and the theory of parasocial interaction, highlighting two key dimensions: influencer credibility (expertise, trustworthiness, goodwill, and posting consistency) and parasocial interaction (emotional connection, desire to follow, and shared values). Both dimensions directly affect PI, with parasocial interaction being especially influential among Generation Z.

A critical review of theoretical models on PI reveals two main gaps. The first is conceptual fragmentation: while some models rely on classical theories such as the Expectation Confirmation Model (ECM) or the Theory of Planned Behavior (TPB), others adopt emerging approaches like influencer marketing or parasocial interaction, without achieving cross-cutting integration. The second gap concerns the limited generalizability of these models, which are often restricted to specific contexts such as mobile apps or green products. This theoretical dispersion hinders result comparison and highlights the need for an integrative framework for future research.

This analysis is key in mapping, from a historical and structural perspective, the various approaches that have addressed purchase intention (PI). The findings reveal an evolution from functional determinants toward social, emotional, and ecological factors, reflecting shifts in consumer behavior. The study outlines current trends, identifies theoretical gaps, and proposes a useful systematization for future interdisciplinary research agendas. As such, it becomes a valuable resource for both researchers and marketing professionals interested in understanding PI through a multidimensional lens.

The research question: What is the evolution, thematic structure, and interdisciplinary projection of scientific knowledge on purchase intention, according to the academic production indexed between 1995 and 2025? This question addresses the scientific problem of the study and simultaneously justifies the use of bibliometric analysis as a tool for the synthesis and foresight of knowledge surrounding the PI variable.

Table 1. *Most productive authors*

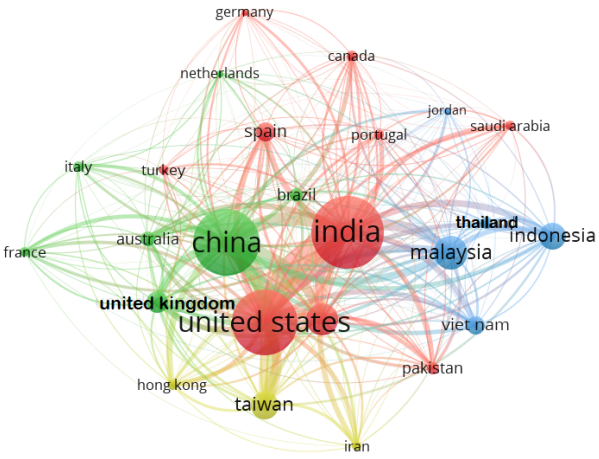
Rank	Author	Articles	h-indice	citations
1	WANG X	108	35	4400
2	LI X	46	25	2542
3	DAS G	66	25	2142
4	SUN Y	74	25	2744
5	KUMAR S	38	20	1412

Note: Information extracted from SCOPUS, May 2025

The author productivity analysis, as shown in Table 1, reveals that Wang X. leads research on PI with 108 publications, an h-index of 35, and 4,400 citations, followed by Sun Y., Das G., Li X., and Kumar S., who also demonstrate high visibility and academic influence. This distribution indicates that impact in the field depends not only on publication volume but also on the consistency of sustained citations.

The scientific collaboration network on PI, as illustrated in Figure 1, is structured into three geographic clusters. The red cluster, led by India and the United States, shows high centrality and strong ties with countries in Asia and the Middle East. The green cluster, with China as the central node, connects Eurasian collaborations with the United Kingdom, France, Italy, and Australia. The blue cluster, comprising Malaysia, Indonesia, and Vietnam, reflects emerging networks in Southeast Asia. This segmentation highlights the concentration of knowledge in regional hubs with high internationalization potential.

Figure 1. Countries with the highest productivity. *Note*, data processed using VOSviewer.



The cluster analysis of keywords reveals a plural thematic structure surrounding PI. Cluster 1, the largest, focuses on consumption and decision-making processes, integrating concepts such as consumer behavior and sales. Cluster 2 highlights a psychological and digital perspective, linking attitude, trust, and electronic commerce. Cluster 3 centers on the communication domain, emphasizing the role of marketing, social media, and social networking as catalysts for PI in digital environments. Cluster 4 adopts a symbolic perspective focused on brand image and perceived value, emphasizing value construction from the consumer's perception.

According to Figure 2, the journal network map reveals a thematic segmentation that structures the field of PI into four main clusters. The green cluster, led by the Journal of Business Research and Journal of Marketing, represents the theoretical core of consumer behavior and quantitative

methodologies. The red cluster, composed of journals such as the Journal of Retailing and Consumer Services and Computers in Human Behavior, focuses on empirical studies of digital experiences and virtual shopping environments. In contrast, the blue cluster, including sources like Sustainability and the Journal of Business Ethics, emphasizes sustainable and ethical approaches. The yellow cluster brings together studies on perception and motivation from the perspective of consumer psychology. This configuration highlights the growing interdisciplinarity in the analysis of PI.

Figure 2. Journals with the highest productivity. Nota, data processed using VOSviewer.



Conclusions

Purchase intention has reached a solid level of theoretical maturity, evolving from functional models toward approaches that integrate multiple dimensions. However, thematic fragmentation persists, highlighting the challenge of consolidating integrative comparative frameworks. A sustained growth in PI research is confirmed, with an annual growth rate of 18.6% and a high average citation count. India, China, and the United States lead in research output, while authors such as Wang G.X., Li X., and Das G. stand out for their h-index. Keyword and co-citation analyses reveal a structure organized around four clusters: economic-commercial, psychosocial-digital, symbolic-perceptual, and sustainable-ethical. Additionally, journals such as the Journal of Business Research, Journal of Marketing, and Journal of Consumer Research serve as the main dissemination channels.

It is revealed that PI has practical applications in sectors such as e-commerce, social media, green products, and luxury, as it is closely linked to user experience, perceived value, and influencer credibility. Its strategic use as a predictive variable enables the anticipation of consumer behavior, adjustment of commercial strategies, and segmentation of users based on utilitarian, hedonic, or ethical motivations. In digital contexts and emerging markets, measuring PI supports data-driven decision-making, positioning it as a key asset for business innovation.

The main limitation identified is geographic bias, with a high concentration of studies conducted in India, China, and the United States, while underrepresented regions such as Latin America and Africa are largely excluded. This omission limits the global understanding of PI and hinders the development of culturally inclusive theoretical frameworks. In addition, specific barriers are evident in e-commerce (digital distrust and perceived risk) and green products (high prices and limited environmental education). Future research is encouraged to adopt mixed methods and context-sensitive approaches to promote inclusion, sustainability, and a user-centered digital transformation.

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Agricultural policy, innovation and upgrading to global value chains

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Introduction

The municipality of Los Reyes, Mexico, produces approximately 90% of the total blackberry in the country (Sistema de Información Arancelaria Vía Internet [SIAVI], 2025), generating intense production and commercial activity in the region. However, this territory has not achieved the economic development necessary to distribute economic and social benefits to both those involved in cultivation and the general population. Multinational companies operating in the area export the fruit, buying it from local producers at low prices and reselling it at much higher prices, 34% of these exports goes to the United States market (Sistema de Información Arancelaria Vía Internet [SIAVI], 2025). In this reality a substantial question arises: how can the producers of Los Reyes manage to convert the advantage of being the largest producer of blackberries in Mexico into an upgrading to the global value chain of this crop? Achieving such an advantage would increase the quality of life of the population, as well as generate conditions to establish new forms of production organization such as a local innovation network or an agro-industrial cluster, allowing better conditions for the population of the municipality.

In this context, there are two key elements for improving the integration of producers into the blackberry global value chain (GVC), as well as greater retention of locally generated economic value: (1) public policies emanating from the municipal government that need to be inclusive, and (2) process and marketing innovations. Based on agricultural policy and the organization between actors and institutions such as universities and technological and research centers, it is more feasible to generate processes of absorption and adaptation of innovations, that allow optimizing productive processes and finding new forms of commercialization to reduce the commercial and financial dependence of producers towards multinational companies (Cantillo *et al.*, 2019).

Agricultural policy

Agricultural policy requires having a clear and defined orientation of the objectives-lines of action that are planned to be achieved, as well as operating as a catalyst that allows guiding towards common initiatives of the actors involved (Jiang *et al.*, 2024). Nenci *et al.* (2022) refers to the fact that, with the passage of time derived from trade liberalization and international protocols on international trade, agricultural policy has acquired ways of seeking efficiency, being dynamic and integrating other policies such as industrial, environmental and technological. Given that rural products have acquired a highly relevant position within the framework of globalization and the increase in the flow of goods. Other authors like Pineli & Narula (2023) consider that foreign direct investment can be a catalyst for economic development when there are public policies that contribute to change productive structures, besides that agriculture is a foundation for the well-being of society and requires efficient management (Coluccia *et al.*, 2020).

Innovation

Frequent and reference perspective in literature related to innovation, is the one that focuses on the generation and absorption of knowledge to realize more efficient processes and greater benefits, whether in the business, government or social sector (OECD, 2015). This research work focuses on two specific forms of innovation: (1) process innovation and (2) marketing innovation These are key points for improving the terms of negotiation between local producers and multinational marketers. Through gradual increases in innovation in the ways of producing and marketing, farmers can scale their position in the GVC (Benito *et al.*, 2022). Innovation has evolved over time as trade relations between developed and developing countries have become closer and more complex. In cases like this the geographical distance between a multinational host region and its R&D centre increases innovation costs, which is an opportunity to generate innovations for local companies (Perri & Santangelo, 2023). Innovation has absorbed knowledge form areas that 20 years ago did not exists or were not developing their theoretical core. Consequently, the modern perspective is more complex and has direct effects on society (Lema *et al.*, 2021).

Upgrading

The concept of upgrading originates in international trade and highlights the hierarchical nature of global value chains (GVCs), where multinational companies often dominate pricing and negotiation, capturing most of the economic value and leaving developing regions at a disadvantage (Gereffi et al., 2005; Pietrobelli *et al.*, 2021). To counter this, local firms must renegotiate their roles in GVCs by improving their position, which requires supportive public policies, financial and technological resources, and stronger links to global innovation systems (Fiorentin *et al.*, 2023; Mudambi & Santangelo, 2016). When conducting the literature review a gap was found in the relationship between agricultural policies, innovation and its effect on the upgrading processes of blackberry producers in the municipality of Los Reyes, this situation adds to the financial and commercial difficulties faced on a daily basis by a large number of farmers of the crop under study, justifying the present work that can be replicable in some aspects, given that this situation is also present with other crops and in other regions in Mexico.

This study is relevant because it can contribute to the processes of design and implementation of agricultural policies, as well as to the expansion of the theoretical core and methodologies related to the case under study.

This section presents the results of the methodology applied in the field. For that purpose, this section of the document was divided into 3 parts: (1) results of the questionnaire (process and marketing innovations), (2) positions (in agreement or disagreement) expressed in the interviews with civils servants and researchers, and (3) the analysis of the MDPs in the last 2 government periods.

Process innovations

The data obtained from the 20 producers surveyed clearly indicates that, in the production process, innovations are incorporated except the use of irrigation systems and macro-tunnels, which have low percentages of 20 and 5%. In the rest of the activities related to the production process, the values fluctuate between 75 and 80% (Table 1).

Table 1. *Innovations in the production process. Source: Own elaboration (2025).*

Preparation for planting	
Soil analysis	80%
Foliar fertilizers	75%
Organic fertilizers	70%
Irrigation systems	20%
Water quality control	60%
Planting/Maintenance and care of process	
Use of macro-tunnels	5%
Pest and disease monitoring	90%
Sanitary pruning	100%
Biological control of pests and diseases	60%
Harvest	
By maturity criteria	100%
By quality criteria (size and color)	95%
Conditioning of harvested product	70%
Harvest scheduling	80%
Adoption of traceability records	55%

Innovations in marketing

Of the 20 producers to whom the questionnaire was applied, all of them sell their product to a marketing company that operates as an intermediary, none has implemented actions to seek new and better ways to place the fruit and directly reach the final consumer, the arguments expressed by the farmers and that explain this reality are reported below. "I/C" means intermediary or marketer (Table 2).

Table 2. *Arguments for not innovating commercially. Source: Own elaboration 2025.*

Innovations in marketing	Frequency	Percentage (%)
I/C secures sales and moderate profit	4	20,0
I/C buys all production	1	5,0
Ignorance of other sales methods	4	20,0
Lack of commercial contacts	4	20,0
With I/C you get more profit	7	35,0
Total	20	100,0

The arguments expressed by the farmers point to a considerable dependence of the producers on the marketing companies in the processes related to the sale or placement of the product in the market.

Interview results

The interviews were carried out with 3 municipal government officials and 3 academics from UNAM, the way in which the information obtained is presented is through the position of being in agreement or disagreement of the interviewed actors (check homogeneity in the wording of the position), in reference to the efficiency and transparency of the agricultural policies at municipal level.

In agreement: 1 civil servant and 1 academic consider that the municipal government of Los Reyes is efficient and transparent both in the design processes and in the operation of public policies. They

consider that modifications are necessary to the MDP as well as the strengthening of technical regulations that allow farmers to have a better basis for negotiation with marketing companies.

Disagree: 3 academics and 2 civil servants stated that the municipal government is neither efficient nor transparent in the policies and lines of action that could generate a better use and scaling up of blackberry producers in the GVC. The agricultural policy is not efficient because most of the economic value of the crop remains with multinational traders, while the economic, environmental and social costs associated with production are mostly absorbed by the producers and the population of the territory under study. Agricultural policies are not transparent either, since there are unclear agreements between the high levels of the municipal public administration and the managers of the transnationals. This happens in such extent that public management is highly functional to the interests of the large traders and intermediaries.

Analysis of the MDP 2018 to 2024

In this analysis, a contrast was made between the systematized information from the questionnaires to blackberry producers (process and marketing innovations) and the interviews with municipal officials and academics (efficiency and transparency in the design and lines of action of the agricultural policy, in the perspective of achieving scaling up in the blackberry GVC). For this it was necessary to review the MDP of the years 2018-2021 and 2021-2024, focusing on the sections related to economic, infrastructure, technological and agricultural aspects (given that these are the sections related to the categories under study). Once this exploration was done it was possible to compare and discover the institutional scopes of the plans in relation to the expectation that producers, municipal officials and researchers have of it (Table 3).

Table 3. Existence of agricultural policy criteria in the MDPs of the municipal government of Los Reyes. Source: Own elaboration 2025.

Criteria	Yes	No
Is there an agricultural policy?	X	
Is it efficient?		X
Is there transparency in the design of agricultural or other related policies?		X
Are there municipality programs that support farmer process innovations?		X
Are there any programs of the municipality that support innovations in farmers' forms of marketing?		X

It can be affirmed that the agricultural policy is neither efficient nor transparent and that it will hardly stimulate upward innovation trajectories in relation to the product and the commercialization strategy, making more difficult for producers to upgrade in the GVC according to Benito (2022). The administrations in the analyzed periods made significant investments in health, security, social support and especially in public works such as new streets, more paving, maintenance and expansion of the hydraulic network, ensuring water supply to both residential areas and blackberry production areas and cultivation orchards of other agricultural products. Similarly, large amounts of public financial resources were invested in roads that allow communication between Los Reyes and nearby municipalities to immediate access to national highways (in less than 20 hours a load of 28 tons of blackberries can reach the southern border of the state of Texas in the USA). It is pertinent to state that all this infrastructure development is highly functional for the operational logistics of multinational trading companies.

All these elements are positive since they contribute to the processes of economic and commercial activity, increasing social welfare. However, they do not contribute to the central objective studied. As Jiang (2024) mentions, agricultural policy requires clear lines of action, which are lacking in the municipality to generate a process of scaling up the crop under study in its GVC and thus generate economic development and a better quality of life for the population.

Conclusion

The municipality of Los Reyes has a great natural wealth that allows it to produce various agricultural products, the one studied in this research is the blackberry. Despite this, the territory does not manage to retain a high (or at least medium) proportion of the economic value and obtain large financial profits, due to the strong hierarchy exercised by multinational marketing companies over farmers. These farmers practically sell their fresh production to these companies, consequently the sale price is low, allowing them to cover the cost of production and obtain a low profit with respect to the operational cost. That is the normal or usual scenario for producers. To get out of this constraint, substantial collaborative work (rather than media work) is required among the various actors involved in this problem.

According to the results, producers adopt production innovations except in technologies related to water management and traceability. In general, they follow a path of gradual upward innovation. There are no innovation practices in marketing, which means that all producers sell fresh produce to multinational marketing companies. So, government must design inclusive, efficient and transparent public policies with lines of action that regulate the way in which the large trading companies globally operate. In addition, the government must direct financial and technical resources in institutional programs that allow stimulating the absorption of innovations at least in processing and marketing. Producers need to prospect new strategies for doing business, starting by replacing antagonistic positions among them with collaborative and joint spaces. If the academic sector can be truly considered, it can contribute to the establishment of ascending and gradual trajectories of innovation, as well as to the professionalization processes of both the municipal government and the producers.

One limitation of the study is the small sample size; however, this is offset by a detailed analysis of the information provided by territorial stakeholders. Sample representativeness is sacrificed for analytical representativeness, which is a characteristic of case studies. A possible line of future research is to find ways to increase organization, proximity and cohesion among the various sectors.

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Analysis of water availability in the Cauca River basin affected by climate change under the CMIP6 scenarios from 2021 to 2100

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Introduction

Climate change impacts on freshwater systems stem from observed and projected increases in temperature, sea level, and precipitation variability, with the United Nations Framework Convention on Climate Change (UNFCCC) defining climate change as a human-influenced alteration that modifies atmospheric composition beyond natural variability, with current evidence identifying anthropogenic activities as the main driver of these changes, and the IPCC's Sixth Assessment Report further confirming that human activities are unequivocally responsible for atmospheric warming, as reflected in the continued rise of greenhouse gases—415.95 ppm of CO2, 1906.11 ppb of CH4, and 335.48 ppb of N2O in 2019—and a human-caused global surface temperature increase estimated between 0.8°C and 1.3°C, signaling unprecedented warming in the last 2000 years; in parallel, land use changes significantly disrupt runoff and hydrological processes in river basins, thereby affecting water supply and ecological functions, with practices such as intensive agriculture, fuel-based mechanization, fossil fuel combustion, and deforestation exacerbating climate-related disasters. To advance understanding of climate dynamics, the Coupled Model Intercomparison Project (CMIP), coordinated by the World Climate Research Programmed, employs multi-model approaches to analyze climate responses from both natural variability and radiative forcing ; the latest phase, CMIP6, incorporates Shared Socioeconomic Pathways (SSPs) and Representative Concentration Pathways (RCPs), which, through diverse climate model data, enhance the accuracy and breadth of future climate scenarios. Each SSP outlines distinct greenhouse gas trajectories considering socioeconomic and technological shifts—including population, economy, urbanization, trade, energy, and agriculture—and five core pathways (SSP1 to SSP5) allow researchers to project a range of climate futures and associated challenges (Riahi *et al.*, 2017; IPCC, 2024).

So, Colombia is a country highly susceptible to the effects of climate change and considers that the increase in emissions is a direct risk to sustainable development opportunities. For the Colombian State, climate change is a primary issue that must be addressed urgently (Cancillería, 2024). According to the Intergovernmental Panel on Climate Change (IPCC), climate change affects both the function and operation of existing water infrastructure, as well as integrated water resource management practices. Flow seasonality in precipitation-influenced basins is expected to experience an increase; in other words, maximum flows are expected to be more pronounced in wet seasons, while minimum flows will be lower during dry periods. Due to these changes and the possible impacts on the economy, environment, and society, it is essential to have a water resource management model designed to face the extreme conditions associated with climate change and the variability derived from it (IPCC, 2024). According to the third national communication on climate change in Colombia, it is projected that 31% of the National Territory will experience a decrease in precipitation in the next 25 years. By the end of the century, an increase of 2.4 °C in the average temperature of the Department is expected, with Buenaventura being the municipality with the largest increase, with additional values of 2.6 °C compared to current reference values. In general terms, a 6% increase in precipitation is anticipated in the Department of Valle del Cauca, with the Western, Southern, and Central provinces, as well as

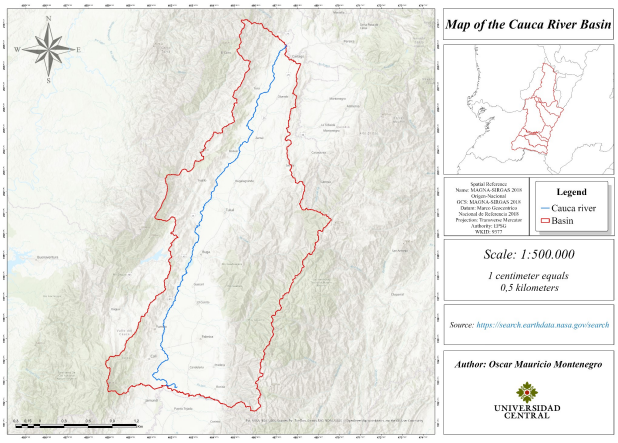
the municipalities of Cartago, Ulloa, El Águila, Ansermanuevo, and Alcalá, being the most affected with increases of up to 20% (IDEAM, 2015).

Consequently, that is why the Cauca River basin is of utmost importance for the country's economy, since, being the second longest tributary in the country, it runs through the departments of Cauca, Valle, Risaralda, Caldas, Antioquia, Sucre, and Bolívar. Agricultural activities such as the sugar industry, coffee cultivation, and other agricultural activities are located there; as well as mining and hydroelectric activities (Meisel, 2011; Pérez, 2015). On the other hand, the demographic burden around the basin represents almost 25% of the national population, leaving aside the main cities of the country where the natural resources of the region are of great importance (Pérez, 2015). For these reasons, the following research question is posed: What will be the impact on water availability in the Cauca River basin due to climate change until the year 2100?

The main objective of this project is to analyze the impact of climate change under the SWAT+ model to predict water availability under CMIP6, SSP245, and SSP585 scenarios from 2021 to 2100 in the Cauca River basin in the department of Valle del Cauca. Likewise, the specific objectives are to evaluate the water supply in the Cauca River basin in the periods most affected by climate change based on the CMIP6, SSP245, and SSP585 scenarios applying the SWAT+ model and analyzing the trend of climatic variables in the Cauca River basin to establish the most affected periods until 2100.

The Cauca River is one of the most important rivers in the country. It has a total length of 1350 km and an approximate drainage basin of 63,300 km^2. It originates in the south of the country in the Páramo de Sotará in the Colombian Massif, Cauca department, located at 2°4'59.58"N 76°39'0.02"W with an altitude of 3200 m.a.s.l., and flows into the Brazo de Loba in the Magdalena River, located at 8°53'10" N 74°27'33" W with an altitude of 15 m.a.s.l. In its basin, as shown in Figure 1, there are approximately 183 municipalities (CVC & Univalle, 2001). In the department of Valle del Cauca, 33 municipalities make up the Cauca River basin, with an area of 1,073,593 Ha, equivalent to 53% of the total area of the department (CVC, 2004).

Figure 1 Location of the Cauca River Basin



According to averages calculated by IDEAM between 1981 and 2010, the mean monthly precipitation shows a bimodal behavior, with values ranging from 97 mm to 205 mm per month, averaging a total of 1732 mm annually. April and October are the rainiest months, as observed in Figure 2.

Generalities and Model Development

The Soil and Water Assessment Tool (SWAT) is a widely recognized model developed by Dr. Jeff Arnold for the United States Department of Agriculture (USDA). Its primary purpose is to predict the impact of land management practices on water generation, sediment yield, and the production of agricultural chemicals within basins and various land uses over extended periods (Uribe, 2010). Since

1994, the model has undergone several updates over the past 30 years, achieving significant advancements in research depth and application fields. This study specifically utilized the SWAT+ 2012 model version (Liu, 2019; Sun *et al.* 2022).

The model's objective in this study is to observe changes in flow and water availability under the proposed scenarios and during the stipulated study period. To perform the water balance, the model employs Equation 1

$$SW_t = SW_0 + \sum_{i=1}^{t} (R_{day} - Q_{surf} - E_a - W_{seep} - Q_{gw}) \quad (1)$$

where SW_t is the final soil water content (mm), SW_0 is the initial soil water content (mm), t is time (days), R_{day} is the amount of precipitation on day i (mm), Q_{surf} is the amount of surface runoff on day i (mm), E_a is the amount of evapotranspiration on day i (mm), W_{seep} is the amount of percolation and bypass flow exiting the bottom of the soil profile on day i (mm), and Q_{gw} is the amount of return flow on day i (mm).

Meteorological data from the IDEAM database were processed to enhance model execution efficiency, focusing on stations with the highest data availability for five key variables: precipitation, maximum temperature, minimum temperature, relative humidity, wind speed, and solar radiation, ultimately identifying daily records from 1980 to 2020 for several municipalities including Cali, Bugalagrande, Zarzal, Palmira, El Cerrito, and La Unión. After downloading, all datasets were compiled and processed to address missing values—often entire days or years—through a Python script based on time-series missing value identification, with averages calculated across stations for each variable over the baseline period. For SWAT+ modeling, this baseline data set was combined with the WXGEN weather generator, integrated into the SWAT+ interface to generate or fill in climatic records as needed, ensuring all inputs were formatted for system compatibility. Future climate projections were sourced from the Copernicus Climate Data Store using CMIP6 data, which includes scenarios SSP245 and SSP585 and is organized by multiple international institutions with the UKESM1-0-LL model selected for this study, offering a range of temporal resolutions from daily to annual and supporting detailed future climate assessments.

Calibration, Evaluation, and Modeling

For the final execution of the model, adjustments were made to the calculations of certain variables to generate more precise results. For the calculation of evapotranspiration, the Hargreaves method was used, employing Equation 2.

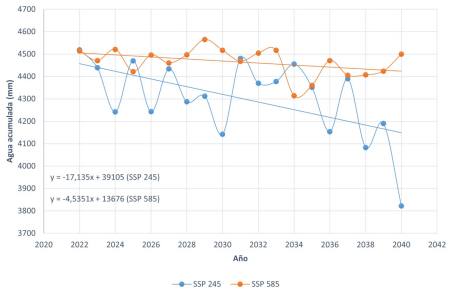
$$\lambda E_0 = 0{,}0023 * H_0 * (T_{mx} - T_{mn})^{0,5} * (T_{av} - 17{,}8) \quad (2)$$

where λ is the latent heat of vaporization ($MJ\ Kg^{-1}$), E_o is the potential evapotranspiration ($mm\ d^{-1}$), H_o is the extraterrestrial radiation ($MJ\ m^{-2}\ d^{-1}$), T_{mx} is the maximum air temperature for a given day (°C), T_{mm} is the minimum air temperature for a given day (°C), and T_{av} is the average air temperature for a given day (°C). After making the necessary adjustments in the modeling, the model requires a temporary adjustment period prior to simulation. In this research, with an 80-year study period, values corresponding to the year 2021 were discarded; this year was used as a "Warm up period" for model execution. Once all parameters were adjusted, two different simulations were performed for each scenario (SSP245 and SSP585).

Evaluation of Water Supply in the Cauca River Basin

In the model, the basin is first divided into multiple sub-basins, and from there, these are further divided into multiple Hydrologic Response Units (HRUs) for simulation. In this study, the Cauca River basin is divided into 9 sub-basins and 1117 HRUs. For both scenarios, water availability across the entire basin was modeled and graphed, with each scenario divided into 4 periods: (2021-2040), (2041-2060), (2061-2080), and (2081-2100). Equation 1 was used to calculate water availability. Additionally, each year and month, the percentage variation of the basin's water accumulation was determined relative to the ratio between the previous year's and the current year's water accumulation. Figure 7 illustrates the water availability in the basin for the four established periods under both scenarios.

Figure 2 a) Annual Variation of Water Availability for the 2021-2040 Period. (b) Annual Variation of Water Availability for the 2041-2060 Period. (c) Annual Variation of Water Availability for the 2061-2080 Period. (d) Annual Variation of Water Availability for the 2081- 2100 period



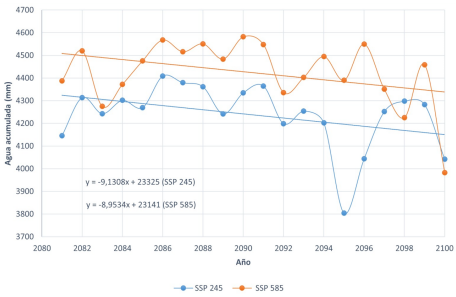
a) 2021-2040



b) 2041-2060



c) 2061-2080

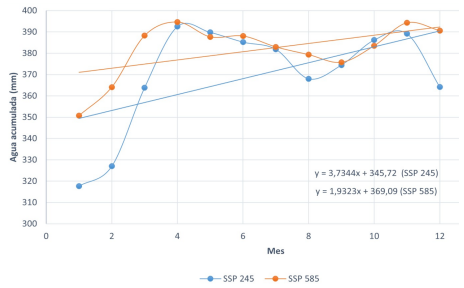


d) 2081-2100

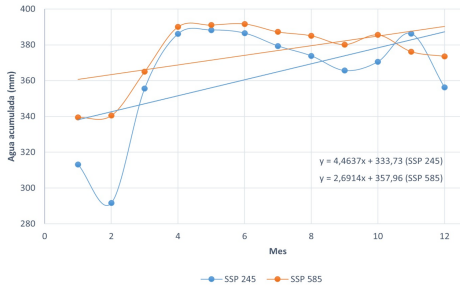
In the SSP245 scenario, Figure 2(a) indicates a decreasing trend in the basin's water availability, with a linear extrapolation suggesting an average annual decline of 17 mm in water storage from 2022 to 2040. The year's most impacted by this scenario are 2030, 2038, and 2040, experiencing an average percentage variation decrease of 6.57% compared to the immediately preceding years. Conversely, 2022, 2031, and 2037 exhibit the most significant increases in water yield, with an average positive percentage variation of 6.73%. The SSP585 scenario in Figure 2(a) also demonstrates a decreasing trend, as the basin is projected to experience an average annual loss of 4.5 mm in storage according to the linear trend equation. On the other hand, 2022 and 2036 are characterized by the largest relative increases in water yield, showing an average positive percentage variation of 9.87%. Under the SSP245 scenario, Figure 2(b) indicates a weighted downward trend, with a linear fit suggesting an annual decrease rate in water storage of approximately 3.3 mm, estimating that 2044, 2050, and 2055 will experience an average reduction in availability of 8.15%. In contrast, the years with improved water yield are 2041, 2047, and 2052, showing an average increase of 10.53%. The SSP585 scenario, as shown in Figure 2(b), exhibits an upward trend, where a linear fit suggests a weighted annual increase in water storage of about 6.3 mm. However, years like 2041, 2045, and 2049 are projected to see a significant average reduction in water availability of 5.24%, while 2042, 2046, and 2053 will experience

a greater average increase of 4.78% compared to the previous period. Figure 2(c) reveals that the SSP245 scenario continues to reflect a descending trend, with a linear fit indicating an average annual reduction of 2.9 mm in the basin's water storage. Years 2061, 2067, and 2073 are projected to be most affected, with an average reduction of 8.71%. Meanwhile, 2062, 2067, and 2072 are expected to show a significant average increase of 6.92%. The SSP585 scenario in Figure 4(c) shows a weighted ascending trend, where a linear fit indicates that the basin's water storage will increase by an average of 3 mm annually. Despite this overall increase, years such as 2062, 2067, and 2073 are projected to experience an average reduction of 6%, conversely, 2063, 2068, and 2074 are expected to see a significant average increase of 4.5%. In Figure 2(d), the SSP245 scenario displays a descending behavior, with the linear trend indicating that the accumulated water quantity will decrease by an average of 9.1 mm annually. Years like 2092, 2095, and 2100 are projected to be the most affected, with an average reduction of 6.3%. Correspondingly, 2082, 2096, and 2097 will show an average increase of 5.17%. For the SSP585 scenario, Figure 2(d) shows a descending linear trend, indicating that the accumulated water quantity will decrease by 8.9 mm interannually. Years such as 2083, 2092, and 2100 are expected to be most impacted, with an average reduction of 6.92%, however, 2082, 2096, and 2099 are projected to experience an average increase of 4% in the basin's water availability.

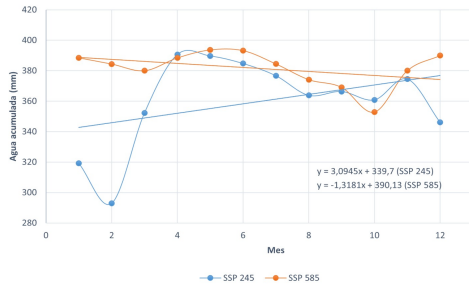
Figure 3 (a) Average Monthly Variation of Water Availability for the Period (2021-2040). (b) Average Monthly Variation of Water Availability for the Period (2041-2060). (c) Average Monthly Variation of Water Availability for the Period (2061-2080). (d) Average Monthly Variation of Water Availability for the Period (2081-2100)



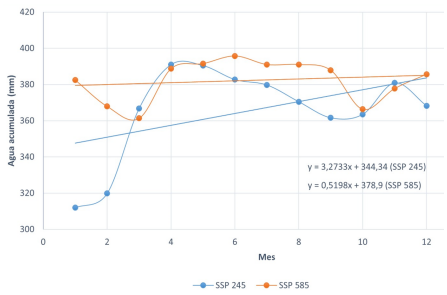
a) 2021-2040



b) 2041-2060



c) 2061-2080



d) 2081-2100

In Figure 3(a), the SSP245 scenario shows an upward trend in water availability, with a linear model fit indicating that monthly storage will increase by 3.7 mm on average; specifically, March and April are projected to see an average increase of 13%, while January, August, and December are expected to experience an average reduction of 6.97%. The SSP585 scenario in Figure 8(a) also demonstrates an upward trend, but with a slower average growth, where the linear trend indicates monthly storage will increase by 1.9 mm on average; February, March, and November are projected to have the best water yield, with an average increase of 7.39%, while January, May, and July are expected to experience an average reduction of 3.13%. Similarly, Figure 3(b) shows that the SSP245 scenario continues with an upward trend, with the linear trend indicating an average increase of 4.4 mm in accumulated water;

January, February, and December are projected to be the most affected months, with an average reduction of 9.41%, while March, April, and November are expected to see an average increase of 14.79%. For the SSP585 scenario in Figure 3(b), an upward trend is also observed, with the linear equation indicating that monthly storage will increase by 2.6 mm on average; January, September, and November are projected to be the most affected months, with an average reduction of 4.29%, while March, April, and October are expected to experience an average increase of 6.22%. Through Figure 3(c), the SSP245 scenario shows an upward trend, with a linear fit indicating an average increase of 3 mm in the basin's accumulated water; January, February, and December are projected to be the most affected months, with an average reduction of 7.64%, while March, April, and November are expected to see an average increase of 12.9%. The SSP585 scenario in Figure 3(c) demonstrates a descending trend, where a linear fit suggests that the accumulated water in the basin will decrease by 1.3 mm on average; July, August, and October are projected to be the most affected months, experiencing an average reduction of 3.19%, while April, November, and December are expected to see an average increase of 5.36%. In Figure 3(d), the SSP245 scenario reflects an upward trend, with linear extrapolation suggesting an average increase of 3.2 mm in the basin's monthly water storage; January, August, and December are projected to be the most affected months, with an average reduction of 6.47%, while March, April, and November are expected to see an average increase of 10%. For the SSP585 scenario in Figure 3(d), an upward trend is also observed, with a linear model fitting for this scenario indicating that the basin's water storage will increase by 0.5 mm on average; February, March, and October are projected to be the most affected months, with an average reduction of 3.65%, while April, November, and December are expected to experience an average increase of 4.97%.

Precipitation is a key driver of water recharge and hydrological dynamics in the Cauca River basin, and model projections for both SSP245 and SSP585 scenarios suggest an overall decline in annual precipitation from 2021 to 2100, with average yearly decreases of 4.9 mm and 6.3 mm, respectively, although monthly averages under these scenarios are expected to surpass those seen between 1980 and 2020, particularly with notable increases in April, May, and October for SSP245, which exhibits a pronounced bimodal pattern, while SSP585 presents a unimodal distribution consistent with findings by Mollel *et al*. (2023), yet this contrasts with IDEAM (2015), which reported only a 6.14% change for the region; in addition, while Waheed *et al.* (2024) observed rising precipitation over time in both scenarios, this study projects a local decrease for the Cauca River basin—resulting in increased runoff and flood risk only under SSP585—and this divergence is amplified when comparing with Colin *et al.* (2024), who documented a decrease for the Mixteco River basin under SSP245. Specifically, this study predicts SSP245 precipitation will decrease by 140 mm between 2021–2060 and by 194 mm from 2061–2080, then increase by 57 mm from 2081–2100. Regarding temperature, Mollel *et al.* (2023) documented a 0.6 °- C – 2 °C increase in Tanzania's Usangu basin, a trend like this study, whereas IDEAM (2015) projected only a 2 °C rise based on older CMIP5 models in contrast to the 6 °C projected here—likely reflecting Colombia's lack of model updates. These patterns align with broader climate change effects such as more intense precipitation, ecosystem loss, and heightened drought and water scarcity as noted by the IPCC (2018). For streamflow, the SSP245 scenario indicates the lowest flows, with a consistent annual decline of approximately 0.7 m^3/s, while the SSP585 scenario projects a rise of 0.15 m^3/s per year; compared to historical flow data, SSP245 predicts average reductions of 48%, 9%, and 13% in the first three periods (2021–2080), followed by a 3% increase at century's end, whereas SSP585 forecasts average reductions of 42% and 4% for the first two periods, a small 0.25% increase in the third, and an 8% rise from 2081–2100. Contrastingly, Feyissa *et al.* (2024) estimated mean flow could increase up to 21.98% and 56.46% for SSP245 and SSP585 in 2031–2060 and even higher by 2071–2100, but this study finds considerably more modest increases in the Cauca basin (3% and 8%), with monthly analysis revealing dry season lows in January, February, March, and September (mean flows of 7.78 m^3/s for SSP245, 14.71 m^3/s for SSP585), and peaks above 200 m^3/s in May, June, and July; given that only six years of observations from two stations are available, these projections

must be viewed cautiously and highlight the continuing need for robust hydrological modeling to explore future climate change impacts on regional water resources and related ecosystem services. In summary, the implemented model successfully generated daily time series for key variables involved in water balance quantification, though a noticeable limitation in data density emerged when compared to existing reference information, indicating room to enhance efficiency in model calibration and adjustment. Future research is advised to employ baseline datasets spanning at least 30 continuous and recent years, encompassing not only climatological parameters but also additional factors influencing water availability, and to conduct comprehensive comparative analyses across institutional data sources to expose inconsistencies and reinforce the reliability of input data. Furthermore, refining the model through targeted calibration and adjustment could improve water yield representation, while expanding the study to include soil quality modeling within the basin presents a valuable next step. The current lack of Colombian governmental studies utilizing sixth phase Coupled Model Intercomparison Project (CMIP6) models reveal a methodological gap that may affect comparability with research based on the latest climate projections, thus introducing potential inconsistencies. Ultimately, this study establishes a significant foundation for future work involving mitigation and adaptation strategies under climate change, as well as for specialized research on the response of individual variables and the identification of potentially affected parameters.

Conclusions

The primary objective of this research is to evaluate water supply in the Cauca River basin under CMIP6 scenarios SSP245 and SSP585, revealing that for SSP245, the greatest reduction in water availability, a 10% decrease, is projected for 2055, while 2041 is expected to experience a 15% increase; for SSP585, 2100 is anticipated to have a 10.68% reduction in water availability, with 2068 showing the largest increase at 6.65%. Monthly analysis indicates January, February, and October are most susceptible to decreases, whereas April and November are likely to see the greatest increases under both scenarios; notably, SSP585 exhibits greater inter-monthly variability, suggesting a more unstable water regime potentially impacting land use and water availability for adjacent municipalities. Trend analyses of key climatic variables highlight that both precipitation and mean river flow will be significantly affected, with SSP585 presenting more severe changes—precipitation will be notably altered, and while mean river flow is expected to decrease under SSP245, it will increase in SSP585, raising flood risks especially in May and June. Temperature is also a critical consideration, as mean values could rise by up to 6°C in SSP585 by 2081–2100. Consequently, models and analyses such as those presented are crucial for national water bodies, enabling both governments and communities to design and implement timely mitigation and adaptation strategies, informing sustainable water resource projects, management plans, and effective risk management based on anticipated climate change impacts on the basin.

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Rethinking Management Models for Urban Regeneration: Factors and Strategies Toward Sustainable and Inclusive Planning

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Introduction

Territorial management models represent a strategic opportunity to reorient the objectives, processes, and methodologies designed to plan, finance, and develop the city at various scales, where interaction with urban stakeholders interested and involved in the sustainable development process is fundamental. Proper urban planning, supported by robust management processes, enables urban regeneration to become an efficient pathway for city development. Urban regeneration, when supported by sound management models, should serve as a driving force to guide cities toward a sustainable growth transition. In this context, planning decisions must not isolate urban actors, who are key elements in fostering participation and achieving economic and social impact within urban conglomerates. This article aims to explore, from the perspective of various scholars and management models, how urban regeneration can be made more effective through the identification of factors and strategies in scientific literature. The focus is on how urban actors can collaborate for the common good, advancing toward the construction of inclusive and sustainable cities. Following this introduction, the methodology section outlines the process of scientific literature review and the identification of relevant authors. The results present the key factors that contribute to urban regeneration, along with strategies associated with management models. The discussion section offers critical perspectives and reflections from the literature that help to strengthen actions and outlooks for urban development.

The main objective of this article—part of an ongoing doctoral research project—is to analyze theoretical approaches through a systematic review of authors who reflect on management models aimed at urban regeneration. The article presents three specific objectives to help rethink urban management models: 1. To contribute with a systematic literature review and analysis that provides a broader understanding of urban regeneration and management models. 2. To identify factors and strategies addressed in previous studies that help integrate key concepts and provide tools for urban management processes.

To achieve a broader search scope, keyword combinations were used, as illustrated in Table 1. The search yielded 1,705 articles, from which 32 were identified as having titles that comprehensively addressed the search criteria, allowing for precise and relevant topic selection. These were further filtered by evaluating the relevance of abstracts and full-text content. As a result, 18 articles were identified as relevant based on their titles and abstracts. From these, 16 articles were selected for full analysis and were examined in detail.

Geographically, the selected articles represent research across four continents: Europe, Asia, North America, and Africa. Europe contributes the most with 6 articles (37.5% of the total). Asia and Africa each contribute 4 studies (25% respectively). North America has the least representation with 1 article

(6%). However, a portion of the literature (31.25%) does not specify a geographic location, focusing instead on theories and concepts addressing the study's keywords. Latin America has limited scientific articles on the topic, although practical experiences in the region offer valuable insights. This highlights the importance of this article in contributing knowledge applicable to Spanish-speaking countries. (Table 1).

Table 1. *Selection Criteria for Bibliographic Review*

Palabras claves español	Keywords in English	Total results	Selected by Article Title	Selected by Abstract / Full Article	Geographic Location
Modelos de gestión urbana + Desarrollo Urbano sostenibles	urban management model + urban sustainable development	493	11	8	
Actores urbanos + Modelos de Gestión Urbana + Procesos de modelos de gestión urbana	urban stakeholders + urban management model + urban management processes	707	10	6	España, China, Irlanda, Tanzania, Portugal, Francia, Inglaterra, USA
Modelos de gestión + Mejoramiento de barrios	management model+ neighborhood improvement	505	11	4	

Following the complete analysis and systematization of the information, one of the main contributions of this article is the identification of different methodologies used in the reviewed studies. These include the responsiveness of selected articles to the research objectives, the methodologies applied by authors, and the contextual application of the studies for a broader conceptual framework. The analysis shows that most studies employ mixed methods, allowing for a comprehensive evaluation of the selected literature. (Table 2)

Table 2. *Summary of Authors and Methodologies Applied.*

Article by author	Article title	Qualitative	Quantitative	Literature Review
Datola Giulia	Implementing urban resilience in urban planning: A comprehensive framework for urban resilience evaluation			x
Llinares Carmen, Page Alvaro, Llinares Jaime	An approach to defining strategies for improving city perception. Case study of Valencia, Spain	x		x
Berger Elisabeth, Blanka Christine	Comprehensive and multifaceted perspectives on sustainability, urban studies, and entrepreneurship			x
Bi Chenyang , Little John C.	Integrated assessment across building and urban scales: A review and proposal for a more holistic, multi-scale, system-of-systems approach	x		x
Fiorentino Stafania	Public-led shared workspaces and the intangible factors of urban regeneration in UK coastal towns	x	x	x
Guo Bin , Zhou Runyu	Systemic Research on Owner Participation in Old Residential Community Management from the Perspective of Identity——a Case Study of a Typical Old Residential Community in Xi'an, China	x		
Kura Lukman, Safo Abraham.	Sustainable architectural design and land-use application to civic centers in Ghana: the case of Damongo	x		x
Luederitza Christopher, Langa Daniel J, Von Wehrdenb Henrik.	A systematic review of guiding principles for sustainable urban neighborhood development	x		

MacElfuff Linda	The Octagon Values Model: community resilience and coastal regeneration	x		x	
Moroke Tseliso, Schoeman Carel, Schoeman Ilse.	Developing a neighborhood sustainability assessment model: An approach to sustainable urban development				x
Paulo Layson Joseph & Nankai Xia	Public participation and satisfaction in urban regeneration projects in Tanzania: The case of Kiriakou, Dar es Salaam	x		x	
Pelorosso Raffaele	Modeling and urban planning: A systematic review of performance-based approaches	x		x	
Rosa-Jimenez Carlos, Rosa-Jimenez Maria Jose, García Alberto E et Moreno and Daniel Navas-Carrillo	Neighborhood cooperatives for the integrated urban regeneration of mass housing areas: speculations on a proposed model	x		x	
Soma K., Dijkshoorn-Dekker M.W.C., Polman N.B.P.	Stakeholder contributions through transitions towards urban sustainability			x	
Stanitsa Avgousta	Investigating key factors influencing decision-making in the design of buildings and places: A survey of stakeholders' perception	x	x	x	

The systematization of the information, from the perspective of management models in city development processes, reveals key factors that should be incorporated into strategies designed to strengthen urban regeneration. A comprehensive development vision leads authors to align key elements such as: Urban Design and Planning, Urban Management Model Development, Sustainable Development Concepts, and Urban Actor Participation. According to the reviewed literature, each factor must be accompanied by specific strategies within management models to comprehensively contribute to urban regeneration. The systematic review identified several important factors embedded within urban regeneration processes. Based on the recurrence and depth of the analysis, the following factors were established as essential for reflecting on strategies that can strengthen management models. (Table 3)

Table 3. *Factors and Strategies in Management Models for Urban Regeneration*

Factors Contributing to Urban Regeneration Processes					
Article by Author		**F1: Urban Design / Urban Planning**	**F2: Urban Management Models and Processes**	**F3: Sustainable Development**	**F4: Urban Stakeholders**
Berger Elisabeth ,Blanka Christine	Strategies for Management Models for Urban Regeneration		Entrepreneurship	Urban Transition toward Sustainability	
Bi Chenyang , Little John C.		Urban Design Systems		Sustainability	
Datola Giulia			Evaluation Frameworks / Multidimensional Systems	Urban Resilience / City Resilience	
Fiorentino Stafania		Urban Regeneration			Social Cooperation Structure
Guo Bin , Zhou Runyu					Community / Identity / Participation
Kura Lukman, Safo Abraham.		Urban Design / Sustainable Land Use			Participation
Llinares Carmen, Page Alvaro, Llinares Jaime		Urban Research Strategies	Urban Management		Citizen Evaluation
Luederitza Christopher, Langa Daniel J, Von Wehrdenb Henrik.		Redevelopment through Urban Design	Interdisciplinarity	Neighborhood Resilience	
MacElfuff Linda		Regeneration	Value-based Models	Resilience	Community / Governance
Moroke Tseliso , Schoeman Carel , Schoeman Ilse.		Neighborhoods	Integral Evaluation Models	Sustainability	
Paulo Layson Josepg & Nankai Xia		Urban Regeneration			Participation
Pelorosso Raffaele			Systems / Standards		
Rosa-Jimenez Carlos, et al.		Urban Rehabilitation	Economies of Scale		Social Responsibility
Soma K., Dijkshoorn-Dekker M.W.C., Polman N.B.P.					Urban Stakeholders / Governance
Stanitsa Avgousta		Urban Design / Sustainable Land Use			Decision-making

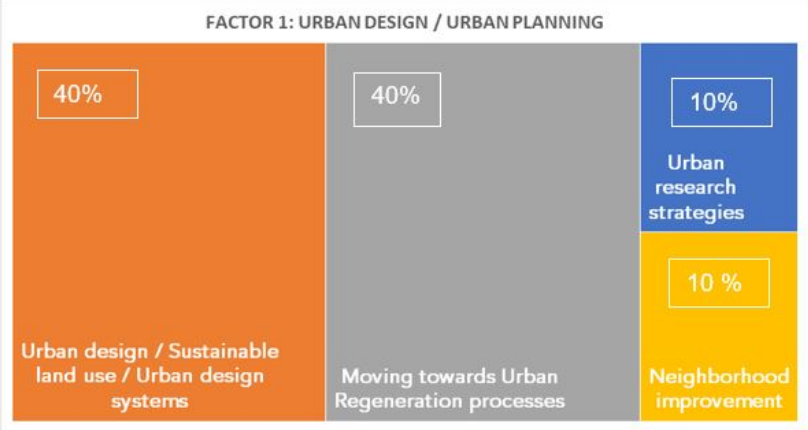
Factor 1: Urban Design and Planning

Urban research allows for the analysis of strategies and systems related to land design. Urban rehabilitation is one of the principal operations in cities and a critical strategy in urban planning. According to Rosa-Jiménez et al. (2023), addressing integral urban rehabilitation requires a collaborative understanding to overcome the main financial obstacles present in current urban practices. Addressing rehabilitation topics requires the correct application of land use regulations, supported by SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) in the targeted territory (Lukman Kura Abraham Safo, 2024).

According to Llinares et al. (2013), urban strategy management improves city perception. Citizen satisfaction is essential not only for urban management but also for the impact on market value and the city's image. Proper land-use designation and regulation can bring socio-economic and physical improvements to communities, potentially leading to effective public policy frameworks. Community development depends significantly on land-use regulations and multiscale strategies for effective urban planning in regeneration processes.

One key proposal in this area is to assign proportional weights to strategies: 40% for sustainable land-use design integration, 40% for regeneration-oriented design processes, and 10% respectively for promoting urban research and neighborhood upgrading programs. These strategies collectively strengthen the Urban Design and Planning Factor, supporting comprehensive urban management models. (Figure 1)

Figure 1. Summary of Strategies for Urban Design and Planning in Urban Regeneration Models.



Factor 2: Urban Management Models and Processes

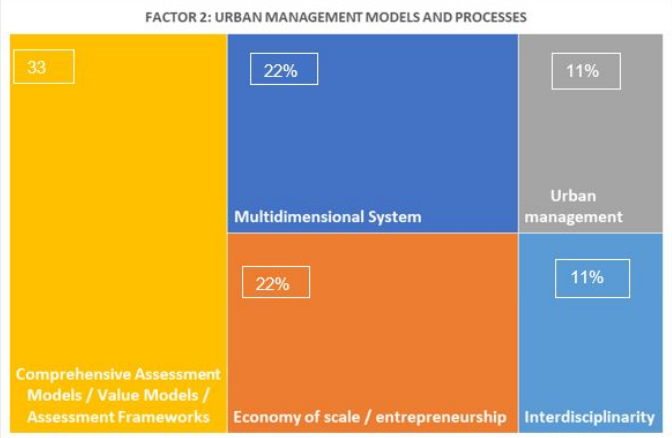
The study reveals that effective urban management models require the use of tools across multiple dimensions. To achieve transdisciplinary, these models must be approached from an ecosystem perspective to offer sustainable management frameworks (Berger Elisabeth, 2023). According to MacElfuff Linda (2016), management models should be structured around an "Octagon" of values conceptual model that fuses regeneration with resilience. This octagon is grounded in four universal sustainability values: environment, economy, society, and governance. Authors such as MacElfuff Linda (2016), Bi & Little (2022), and Luederitz et al. (2013) affirm that this strategy enriches management processes by aligning needs, priorities, and values.

Bi & Little (2022) define landowners as integral components of management systems, echoing Pelorosso (2020), who asserts that these actors must align their objectives and sustainable decisions to effectively participate. Ownership engagement is often driven by cost-benefit considerations, and their active involvement is seen as a prerequisite for model implementation. A recommended strategy for applying urban management models is to focus on neighborhoods by implementing integrated participation systems and evaluation tools (Datola, 2023). This can reduce urban regeneration costs and assess successes and failures, by applying principles such as economies of scale and mobilizing self-sustained economic resources for urban rehabilitation (Rosa-Jiménez et al., 2023).

A percentage-based analysis was used to assess the strategic importance of various actions to strengthen management models and processes. Those include: 33% integrating comprehensive evaluation tools within management models, 22% focusing on indicator systems and multiscale actions for urban regeneration projects, 22% applying economies of scale and developing economically sustainable project models with active stakeholder participation and 11% strengthening urban management within urban-architectural projects, ensuring territorial application and deliverables.

Interdisciplinarity is crucial to fostering public-private partnerships that support real estate-based urban management strategies. (Figure 2)

Figure 2. Summary of Strategies Related to Urban Management Models and Processes



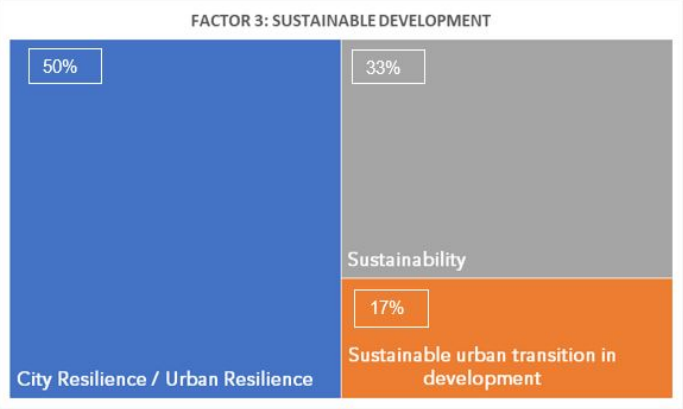
Factor 3: Sustainable Development

Urban resilience concepts (Stanitsa Avgousta, 2022) are increasingly intertwined with sustainable development within urban planning and management models. Authors emphasize empowering landowners and ensuring participatory norms to prioritize short- and long-term sustainable management actions (Bi & Little, 2022; Moroke et al., 2019). In the broader context of urban development, city administrations and urban actors play a critical role in ensuring that sustainable land use principles and environmental preservation remain central to regeneration strategies (Lukman Kura Abraham Safo, 2024; Luederitz et al., 2013).

Sustainable development, as the final objective, must be shaped through stakeholder participation—enabling diverse interpretations of sustainability (Soma et al., 2018). Such inclusive engagement allows stakeholders to take on a more significant role in driving urban regeneration aligned with sustainability goals. A community-based approach has often been advocated as an effective means of achieving locally relevant sustainable development outcomes. This approach facilitates improved decision-making, planning, and management (MacElfuff Linda, 2016). Ultimately, the evolution of sustainability theories must guide transitional processes in urban development (Berger Elisabeth, 2023).

Analyzing the broad range of author perspectives has enabled the synthesis of several key points, ranked by their level of emphasis: 50% sustainable development must be driven by resilience, applied across various scales—from neighborhood-level initiatives to citywide policy development. 33% sustainability should be embedded in every project action. Reaffirming the importance of clearly identifying which Sustainable Development Goals (SDGs) are addressed 17% urban models must be conceptualized within a transition framework to sustainability, establishing temporal baselines that enable the measurement and evaluation of outcomes. In this transition, the urban actor plays a vital evaluative role. (Figure 3)

Figure 3. Summary of Strategies Related to the Sustainable Development Factor.



Factor 4: Urban Actors

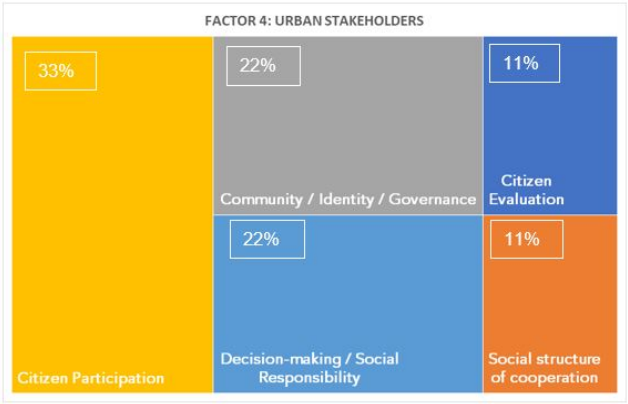
The final factor identified in the study is the participation of urban actors—referred to in some studies as landowners (Bi & Little, 2022; MacElfuff Linda, 2016; Guo Bin, 2020; Luederitz et al., 2013). Their involvement is analyzed across three levels: external, internal, and intermediate, each contributing to environmental development (Bi & Little, 2022; Stanitsa Avgousta, 2022). This level of engagement suggests the need for urban management models that incorporate community-based approaches. From the perspective of social awareness, participatory factors have played a significant role in progressively improving neighborhood dynamics, which the literature identifies as a suitable scale for implementing regeneration-oriented management models.

Fiorentino Stefania (2023) asserts that a cooperative social structure—viewed through a political lens—enhances understanding of local history, a critical dimension in urban interventions, positioning actors as a central priority. It has been demonstrated that beyond achieving economic benefits, urban actors engaged in cooperative structures can attain social, physical, and environmental gains. These benefits serve as a foundation for comprehensive urban rehabilitation management (Rosa-Jiménez et al., 2023).

The involvement of urban actors in governance models evokes the idea of public life participation, a notion rooted in classical Greek democracy. While contemporary democratic frameworks are primarily representative rather than participatory, there have long been calls from both ends of the political spectrum advocating for greater direct influence of citizens over decisions that impact on their lives (Paulo Layson Joseph & Nankai Xia, 2015). This demand directly relates to urban development decisions at the local level.

The findings of this factor reaffirm the relevance of urban actors in management models. As a general criterion, the importance of urban actors is framed around their ability to connect strategies across political, economic, and cultural domains for decision-making at the city level (Mejía G., 2024). In terms of strategic importance: 33% of actions focus on measuring citizen participation. 22% recommend developing tools to foster community building, strengthen identity, and restore civic governance. An additional 22% support enabling management models that allow actors to make decisions grounded in social responsibility. Two strategies, each one with 11% relevance, include establishing cooperative social structures and citizen evaluation mechanisms as foundational components in management models. A strong cooperative social structure, supported by organized citizen engagement, facilitates multiscale public-private partnerships. These alliances should be anchored in comprehensive evaluation frameworks that measure the impacts and sustainability of city investments over time. (Figure 4)

Figure 4. Summary of Strategies on Urban Actor Participation in Management Models.



Conclusions

This article demonstrates that although urban management models are applied in various contexts and through different methodologies, the influencing factors in urban regeneration can often be addressed individually yet fail to achieve a truly integrated approach. The analysis shows that studies on urban regeneration highlight urban design and planning as the primary factors. In four out of fifteen reviewed studies, strategies such as land use optimization, planned urban design, and neighborhood-scale rehabilitation are prioritized. The urban actors factor appears in nine studies, positioning it as the second most significant in urban regeneration processes. The urban management model factor is discussed in eight studies, which emphasize multidimensional approaches including economies of scale, interdisciplinarity, standardized implementation processes, and the inclusion of integrated evaluation mechanisms to assess both achievements and shortcomings. The sustainable development factor is presented as a cross-cutting theme, particularly in studies aligned with the 2030 Agenda. It encompasses the need for resilience, sustainability, and transitional urban regeneration processes as essential for achieving global urban objectives. The systematic review confirms that the methodologies used to evaluate urban regeneration models include qualitative, quantitative, and mixed methods, depending on the specific factors and strategies under study.

Most studies (60%) employed mixed methods, including qualitative tools and literature reviews, with an emphasis on case studies, applied theories, interviews, and surveys. When aiming to measure the effectiveness of urban management models, quantitative tools are essential. Consequently, complementing management models with evaluation instruments is crucial, as many studies focus on assessing implementation effectiveness.

The graphical synthesis of findings supports two key contributions: Urban regeneration strategies should not overlook the participation of urban actors in decision-making. The design factor, management model factor, and the social dimension of actors together form a cohesive vision for sustainable development. This integration ensures better outcomes across urban scales. The article contributes tools and methodologies for evaluating regeneration processes, applicable in academic contexts and public policy design. Moreover, this work acknowledges a research gap in Latin America regarding management models for urban regeneration. Bridging this gap is essential to transfer scientific and academic insights from European and Asian case studies to the Latin American context, enabling region-specific strategies for regeneration at multiple urban scales. In conclusion, this article provides a valuable resource for urban planners and decision-makers, offering guidance on how to design and implement effective management models that support sustainable urban regeneration.

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Empowerment of Rural Women in Colombian Agriculture: Methodological Challenges and Lessons Towards Gender Equity

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Introduction

Systematising research in rural contexts is a strategic practice for generating contextualised knowledge and informing initiatives that promote gender equity and sustainable development in territories historically affected by geographic and structural marginalisation ((United Nations Educational, Scientific and Cultural Organization [UNESCO], 2025; Belay et al., 2025). Documenting lessons learned enables evidence-based decision-making rooted in local realities, strengthening collective learning and the adaptation of strategies to invisible contexts.

In African and Asian regions, systematisation has proven useful to reveal gender gaps and improve women's economic autonomy through inclusive agricultural policies and microcredit access (Abdu *et al.*, 2022; Adebayo & Worth, 2024; Kirkwood *et al.*, 2021). In Latin America, studies highlight the relevance of recording gender-sensitive practices to ensure replicability and impact (Barrios *et al.*, 2020). Colombian experiences confirm that this methodological approach supports rural women's leadership, autonomy, and productive inclusion (Finke *et al.*, 2021; Yoshioka *et al.*, 2023; Gómez & Gómez, 2022).

This chapter systematises the doctoral project "Assessment of the Empowerment of Rural Women in Agriculture: Personal, Relational and Environmental Analysis in Colombia", addressing methodological challenges in adapting instruments, selecting representative samples, and integrating variables related to production, legal awareness, and community participation. Aligned with SDG 4 (Quality Education), SDG 5 (Gender Equality and Rural Women's Empowerment), SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), and SDG 17 (Partnerships for the Goals), this study contributes to advancing strategies that promote rural women's participation and agency. The guiding research question was: How is the empowerment of rural women in peasant agriculture in Colombia manifested from a personal, relational, and environmental perspective?

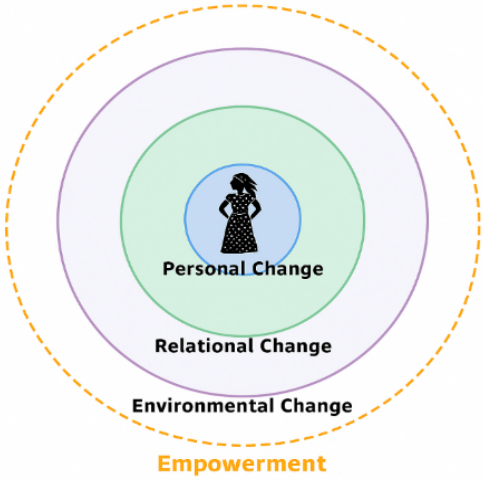
Expressions of Women's Empowerment: Individual, Collective, and Structural Transformations

Rural women face persistent structural barriers across global, national, and local contexts, including precarious employment, limited access to education, and gender-based violence—conditions intensified in Colombia by armed conflict and exclusion from decision-making spaces (UNESCO, 2023; Ministry of Agriculture and Rural Development [MADR], 2022). These inequalities restrict their economic autonomy and reinforce their marginalisation within territorial and social structures (National Administrative Department of Statistics [DANE], 2020; ONU Women, 2023). Empowerment in agriculture emerges as a contextual and historical process grounded in rural women's lived

experiences and daily practices. It is defined as the capacity to recognise and exercise power individually and collectively, rooted in local knowledge and solidarity (Martínez-Daza, 2024; Chen & Barcus, 2024). Since 1994, interest in this topic has grown within academia and institutions, especially regarding the need to design culturally sensitive strategies that strengthen women's leadership without detaching them from their territories (Martínez-Daza & Guzmán, 2024).

Despite international efforts such as SDG 5, gender gaps persist in rural areas, particularly in economic decision-making, land ownership, and political participation (Bryan *et al.*, 2024; Tanzile *et al.*, 2023). Nonetheless, Colombian cases show that participation in agroecological and environmental projects enhances women's control over natural resources and fosters sustainable community engagement (Chávez *et al.*, 2022; Pachón, 2022). From a theoretical standpoint, empowerment is multidimensional and operates on three interrelated levels: personal, relational, and environmental (VeneKlasen & Miller, 2002; Lombardini et al., 2017), as illustrated in Figure 1. Personal empowerment refers to self-esteem, autonomy, and decision-making, often enhanced by access to technical training and entrepreneurship programmes (Finke *et al.*, 2021; Zuñiga & Pineda, 2022). Relational empowerment involves participation in cooperatives, leadership roles, and joint decision-making within households and organisations (Basak & Roy, 2023). Finally, environmental empowerment addresses safety, mobility, and access to public spaces, all of which are fundamental for fostering rural women's social and economic inclusion (Goel & Ravishankar, 2021). Understanding empowerment from this perspective allows for the development of differentiated, context-sensitive strategies that contribute to equitable and sustainable rural development (Díaz & Pachón, 2024).

Figure 1. women's empowerment three interconnected levels



Note. This concentric diagram illustrates the three levels of change: personal, relational, and environmental. Each circle encapsulates and relates to the next, culminating in the level of empowerment. The Personal Change (light blue) represents individual transformation and is associated with introspection, confidence, and calmness. The colour blue symbolises internal development and self-perception, which are key elements in personal growth**. Relational Change** (light green) symbolises relationships and connections with others, such as family and the community. Green, representing growth, harmony, and support, highlights the importance of relationships and community ties in the change process. Environmental Change (light lavender or purple) encompasses the social context and cultural norms. Purple is associated with transformation and social sensitivity, which are appropriate for a level that interacts with cultural and societal environments. Empowerment (orange, dotted line) is the outermost circle, surrounding and encapsulating all previous levels. It symbolises the ultimate goal of the process. The dotted line suggests that empowerment is dynamic and expanding, without rigid boundaries, and is continuously influenced by changes at the other levels. The colour orange

conveys energy, motivation, and determination—essential qualities for empowerment and positive transformation.

In this phase, the WEAI was adapted to the Colombian context of Family and Community Peasant Agriculture (ACFC). The resulting instrument was structured into four components: (1) sociodemographic and productive profile, (2) personal empowerment (power within/power to), (3) relational empowerment (power with/power over), and (4) environmental empowerment (structural factors). A purposive sample of 60 rural women engaged in ACFC was selected, applying a characterisation form and subsequently the adapted index. This process enabled the identification of empowerment levels across the personal, relational, and environmental dimensions.

Table 1. Components for Understanding the Empowerment of Women in Agriculture

Components	Dimensions	Indicators
Sociodemographic characteristics		Age – Department and municipality of residence – Marital status – Educational attainment – Household composition – Activities related to Family and Community Peasant Agriculture (ACFC)
Personal Empowerment Index	Power within	Self-esteem and self-efficacy – Women's economic role – Non-acceptance of gender-based violence
	Power to	Individual capacity – Personal autonomy – Decision-making
Relational Empowerment Index	Power with	Group participation – Leadership and influence within community groups – Control over household assets
	Power over	Women's participation in household decision-making – Contribution to household income – Time use and workload – Experiences of gender-based violence
Environmental Empowerment Index		Freedom of movement – Social norms and stereotypes regarding women's economic role

Note. Prepared based on the practical guide for measuring women's empowerment by Lombardini et al. (2017).

In this final phase responded to the identified need to strengthen both personal and collective capacities among participating women. A participatory workshop titled *"Women's Empowerment for Planned Change Management"* was designed, structured into four stages: institutional introduction, conceptual understanding, theoretical exploration, and self-assessment with reflection. Conceived as a situated pedagogical strategy, the workshop aimed to foster awareness, strengthen internal power, and promote solidarity-based empowerment. It supported transformations across personal, relational, and environmental levels, using participatory methods and self-evaluation tools to encourage critical thinking, collective learning, and leadership development among rural women in agriculture.

The systematisation of the research project "Empowerment of Rural Women in Agriculture: Personal, Relational, and Environmental Analysis in Colombia" enabled the identification of methodological challenges, contextual adaptation strategies, and findings regarding the manifestations of empowerment among rural women involved in Family and Community Peasant Agriculture (ACFC). One of the main methodological challenges was the contextualisation of the measurement instrument. The literature review facilitated its adaptation to the Colombian context, incorporating dimensions and categories sensitive to the realities of the participants. At the personal level, items related to legal rights knowledge, such as child custody, alimony, and access to justice, were included. This allowed for the identification of the relationship between the participants' understanding of legal frameworks and their ability to make autonomous and informed decisions in exercising their rights. This level was structured through six questions that assessed various aspects of personal autonomy.

At the relational level, the categories of group participation and community leadership were strengthened in order to evaluate the formal presence of women in organisational networks and their capacity to influence local decision-making processes. Additionally, an inventory of household assets was included, encompassing both agricultural and non-agricultural goods. This made it possible to analyse how property ownership and access to productive resources influence rural women's economic autonomy. Activities such as rural tourism, agricultural product transformation, and artisanal production emerged as key sources of income generation and social recognition within their communities. This level was structured around fourteen questions designed to assess different dimensions of relational empowerment.

Another significant challenge was the heterogeneity of ACFC activities in Colombia. This diversity—ranging from agricultural and livestock production to agro-industrial processing, associative models, solidarity economies, local markets, environmental conservation practices, and multifunctional complementary activities—required specific adjustments. It was necessary to adapt the instrument to reflect the territorial and productive characteristics of each region, ensuring the relevance of the indicators. These needs became apparent during the validation process of the measurement tool, which was conducted through a collaborative pilot involving postgraduate students who served as research assistants. Regarding the role of the research assistants, one challenge was ensuring a proper understanding of the instrument despite the initial training provided. In particular, difficulties emerged in interpreting the logic of some questions, which led to imprecise phrasing during the pilot implementation of the empowerment index. This situation required personalised support in several cases, and in others, the pilot had to be repeated due to errors in the initial application, with some results having to be discarded. Although this extended the timeline, it was crucial to ensure data quality and the appropriateness of methodological adjustments. The pilot helped identify necessary improvements in item wording, enhancing clarity and reinforcing the instrument's applicability to rural contexts.

Another major methodological challenge was ensuring sample representativeness. Geographic dispersion and limited access to certain communities required differentiated selection strategies, resulting in the inclusion of women with diverse trajectories within ACFC. While this approach made it possible to gather a wide range of experiences related to the personal, relational, and environmental dimensions of empowerment, it also meant that the study took on a more general character. Furthermore, during the application of the empowerment index, especially among participants with low educational attainment or limited literacy skills, continuous support from trained research assistants was essential. This situation not only increased implementation time but also required procedural adaptations to ensure the quality and consistency of the data collected.

The study's findings revealed specific expressions of empowerment among rural women in the context of Family and Community Peasant Agriculture. These presented several methodological challenges for analysis. For example, in indicators such as self-esteem, confidence, economic role, non-acceptance of gender-based violence, and decision-making capacity, the main challenge was to foster a safe and trusting environment. This was achieved through respectful, clear, and motivational communication that encouraged participants to share their personal and everyday experiences. This approach enabled an understanding of personal and relational empowerment without influencing responses or compromising their authenticity. However, this strategy also required a greater time investment in both data collection and analysis. An additional challenge involved administrative procedures and logistical management necessary to implement the methodological proposal through networks or collectives of rural women. Despite efforts to establish contact and disseminate invitations for participation, many organisations did not respond, which limited the initial scope of the fieldwork. This situation required the reformulation of engagement strategies and reliance on individual contacts, which demanded more time, resources, and coordination. It also highlighted the need to strengthen institutional channels to facilitate the involvement of intermediary organisations between researchers

and participants, thus ensuring the inclusion of rural women in future studies and intervention processes.

Conclusions

The systematisation of this research experience makes it possible to conclude that the methodological analysis of the empowerment of rural women in peasant agriculture, from a personal, relational, and environmental perspective, offers valuable inputs for guiding future research and intervention initiatives. For example, the incorporation of variables specific to the Colombian context—such as control over non-agricultural productive assets, access to legal rights, and participation in community networks—enhances the relevance and applicability of measurement instruments in similar studies.

This study made it possible to highlight how the empowerment of rural women is expressed not only through the strengthening of individual autonomy but also through the consolidation of collective capacities and the transformation of community structures. In this sense, it is recommended to progress in the design of intersectoral interventions that integrate leadership training, equitable access to resources, agricultural innovation, and political participation. Likewise, the experience underscores the need to continue validating methodological instruments in a contextualised manner, adapting them to the sociodemographic conditions of each region and recognising local knowledge that supports the sustainability of empowerment strategies. The findings also suggest the importance of promoting evidence-based public policies that address the structural barriers faced by women in Family and Community Peasant Agriculture (ACFC), particularly concerning land ownership, freedom of movement, social norms, and stereotypes related to women's economic roles and their contributions to household income. In this regard, the creation of academic and institutional collaboration networks is encouraged, in order to enhance the replicability of empowerment strategies and studies that generate transferable knowledge for other rural contexts.

Among the main limitations of the study is territorial representativeness, which was affected by the low participation of women and organisations invited to take part in the research process. This limited response reduced the regional diversity of the sample. Moreover, the time allocated for implementing the methodological phases was constrained by institutional academic calendars, which limited the possibility of conducting longitudinal follow-up on the effects. In addition, the territorial implementation of the workshop requires minimum conditions, such as transportation, printed materials, refreshments, and adequate spaces, as well as sufficient human resources for facilitation. The absence of external or institutional funding sources limits the scaling of the proposal and compromises its long-term sustainability. Overcoming the lack of coordination among governmental, educational, and community actors would facilitate the institutionalisation of the pedagogical strategy and the construction of joint pathways for its territorial implementation.

Within this framework, the systematisation carried out constitutes a significant contribution to understanding the empowerment of rural women in Colombia as a transformative process. This process requires adapted, collaborative, and sustainable strategies to strengthen its personal, relational, and environmental dimensions within the sphere of peasant agriculture and from the educational sector.

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Preparation of quicklime and slaked lime employ paper sludge waste

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Introduction

In the paper industry, the production of paper sludge waste is very high, and companies dump the generated waste in landfills, causing increased economic costs and environmental damage. This is why an alternative would be to conduct feasibility and efficiency studies for the alternative use of paper sludge waste as supplementary materials, because after processing these paper sludge waste can have physicochemical characteristics similar to those of quicklime (CaO) or slaked lime ($Ca(OH)_2$, meaning that this waste is fully recycled, avoiding its disposal in landfills, and that it is used as a by-product in various industries. In this experience, the flotation of a polymetallic mineral containing chalcopyrite, galena, sphalerite and other minerals without economic value was carried out. The experimental work started from crushing, then an analysis of chemical composition was made by X-ray diffraction to characterize the mineral and know its mineralogy, then a grindability study was made to calculate the flotation time and finally two flotation tests were carried out using CaO, varying some parameters in search of recovering a bulk concentrate, to see the recovery of the concentrates obtained chemical composition tests were carried out by X-ray diffraction of each concentrate. The procedures, data, and results of this experiment are reported in this report.

Paper sludge for lime

Goñas (2020). It was suggested that lime is a very versatile product with countless applications in a variety of industries, including construction, water treatment, the steel industry, pulp and paper, chemical, agro-industrial, and food, among others. However, it is in mining where its most significant use is found, becoming a strategic input. Its most important use is associated with mineral extraction processes, primarily in flotation processes, where it acts as a pH regulator. In most sulfide flotation systems, pH is controlled by regulating the flow rate of lime slurry (calcium hydroxide) in the process. Hence the importance of having a high-quality and consistent lime slurry to ensure adequate pH control during the flotation process.

Sabador *et al.* (2016). They proposed that the need to properly use industrial by-products requires knowledge of their characteristics, both from a chemical, mineralogical, and physical perspective. The by-product used for this research is coated paper sludge from the paper industry, which uses 100% recycled material as raw material. Due to the high content of organic matter and calcium carbonate and the presence of various clayey materials, such as talc and kaolinite, calcination conditions play a key role in the mineralogy of this sludge. The current work considers the role that these conditions, time, and kiln residence time play in the pozzolanic properties of coated paper sludge as a cementitious material. For this reason, different temperature ranges, between 600 and 750°C and a 2 hour kiln residence time, were studied with the aim of obtaining the best pozzolanic properties.

Zamora *et al*. (nd). In this research, paper mill sludge was successfully used as a raw material in the hydrothermal process for the synthesis of zeolites A, P, and NaP-CaP. This achievement will simultaneously mitigate the pollution associated with the disposal of these wastes and significantly reduce the production costs of these materials. Furthermore, the reduction in zeolite production costs is even more significant because shorter synthesis times were used than those reported in other similar studies. This will also reduce the exploitation of mineral deposits used as commercial raw materials for zeolite synthesis. Furthermore, the importance of conditioning the sludge prior to synthesis, based on its composition, to obtain zeolite precursor compounds, was demonstrated. By implementing the leaching of calcined sludge at 550°C, a 1 M HCl solution promotes the formation of zeolite A, and using a 2 M HCl solution, zeolite type P is produced. These can be used as ion exchange materials and as adsorbents.

Valencia *et al*. (2014). Here, they established that the evaluation of the incorporation of paper sludge as a filler in commercial polymeric raw materials, considering industrial percentages, showed that it can replace traditional fillers, exceeding the normal application percentage without compromising product quality and properties. The study showed that paper sludge mixed with polymers such as PVC can be pelletized for subsequent manufacture into industrial products. The sludge/PE mixing process resulted in products that can be used at the domestic and industrial levels.

Fontalvo & Mercado, 2022. They established that the paper industry produces a waste known as sludge (a mixture of kaolin and cellulose fibers), and due to the high generation of this waste and the environmental burden its disposal represents, the objective of this research is to analyze whether these sludges, a product of papermaking, can be used to partially replace cement. This research contemplated two forms of variables for Kraft paper (PK) and Soft paper (PS) sludges. The first consisted of investigating the calcination temperature of the sludge using TGA to optimize the pozzolanic activity of the ashes, and the second was the variable with the grinding process. In the test corresponding to evaluate the pozzolanic activity of the sludge studied, it was evident that the ashes obtained at 800 °C are those with the highest pozzolanic activity.

De Coimbra (2017). Under the experimental conditions used and in ultrapure water, the char obtained from primary paper mill sludge was able to adsorb the drugs considered (diclofenac, salicylic acid, ibuprofen, and acetaminophen) in equilibrium times of less than 200 min and following pseudo-second-order kinetics. The adsorption rate decreased for the drugs considered in the following order: salicylic acid > diclofenac > ibuprofen > acetaminophen.

Flotation tests of polymetallic minerals

Test 1

The feed ore was ground for 7.78 minutes (50% of the ore – 200 mesh). At the beginning of conditioning, the natural pH of the ore was measured, and then the flotation reagents were added following the flow diagram. After adding each reagent, a conditioning time of 4 minutes was allowed. After conditioning the pulp, the ore was floated in a first stage (Rougher stage), recovering a first concentrate. After this first flotation stage, the air valve was closed and the cell was conditioned again by adding lime, collector, and frother, allowing 4 minutes for conditioning time after adding each reagent (Scavenger stage). Once the cell was conditioned, the ore was floated a second time (Scavenger stage), recovering a second concentrate. Flotation is complete when the bubbles lose color and the minerals of interest are no longer visible at plate screening. The concentrates obtained from both stages are pooled, filtered, and oven-dried. The flotation tailings are also filtered and oven-dried.

Test 2

The feed ore was ground for 7.78 minutes (50% of the ore – 200 mesh), and lime and pyrite depressant were added from the grind. After grinding, the pulp pH was measured, and the flotation reagents were

added following the flow diagram. After adding each reagent, a conditioning time of 4 minutes was allowed. After conditioning the pulp, the ore was floated in a first stage (Rougher stage), recovering a first concentrate. After this first flotation stage, the air valve was closed, and the cell was conditioned again by adding lime, collector, and frother, allowing 4 minutes for conditioning time after adding each reagent (Scavenger stage). Once the cell is conditioned, the mineral is floated a second time (Scavenger stage), recovering a second concentrate. Flotation is complete when the bubbles lose color and the minerals of interest are no longer visible upon plate separation. The concentrates and tailings are filtered and oven-dried.

X-ray diffraction characterization of the head mineral. Table 3 shows the results of the chemical composition analysis of the head mineral and Figure 6 shows the diffractogram corresponding to this analysis.

The moisture content of the paper sludge was determined on an AND MX50 moisture balance, resulting in a value of 66.75%. After drying the six paper sludge samples in an oven at 80°C for 8 hours, the resulting moisture content percentages were: 68.1%, 68.3%, 67.73%, 68.1%, 67.6%, and 68.0%. The average value is 67.97%. During the calcining process, the initial weight of the dry sample (1) was 3.976 g. At the end of calcining at 900°C for 1 hour, the final weight of the sample (1) was 1.577 g, representing a weight loss of 60.34%. During the calcining process, the initial weight of the dry sample (2) was 3.935 g. At the end of calcining at 900°C for 1 hr, the final weight of sample (2) was 1.548 g, i.e., a weight loss of 60.66%. From the X-ray diffraction analysis of the sample calcined at 900°C for 1 hr, it was found that calcium carbonate, $CaCO_3$ (Aragonite), and CaO (quicklime) were present. An alkalinity analysis was performed on the paper sludge samples calcined at 900°C and 1000°C for 1 hr.

In the first flotation test we changed the reagents used in search of obtaining a better quality concentrate for which we worked with the AR 1404 collector that has a high recovery capacity and low selectivity, in order to know the quality of the concentrate a chemical composition test was carried out by DRX where we observed that the concentrate contains a high content of pyrite (18.76%) and the content of chalcopyrite was only a little higher so it was decided to depress the chalcopyrite for the second flotation test, the dosage and reagents used in this test are shown in Table 2, then it was sought to depress the pyrite by adding sodium bisulfite in the grinding so that the conditioning time is longer, in this test we obtained two concentrates, where in the Rougher stage a large amount of valuable mineral is recovered and in the scavenger stage in valuable mineral content. From the chemical composition analysis of these concentrates, we were surprised to find that pyrite continued to appear. This may be due to the fact that the depressant used did not have enough time to act and that the collector is very strong and not very selective. It is worth mentioning that galena recovery was not good (see Table 6) because galena forms slimes quickly, which prevents this mineral from interacting with the collector.

Conclusions

The moisture content of the paper sludge was determined, resulting in a value of 66.75%, meaning the sample has a high moisture content. During the calcining process, the initial weight of the dry sample (1) was 3.976 g. At the end of calcining at 900°C for 1 hour, the final weight of sample (1) was 1.577 g, a weight loss of 60.34%. During the calcining process, the initial weight of the dry sample (2) was 3.935 g. At the end of calcining at 900°C for 1 hour, the final weight of sample (2) was 1.548 g, a weight loss of 60.66%. Therefore, it is established that during the calcining of the sample, there was a weight loss of almost 60.5%.

X-ray diffraction analysis of the sample calcined at 900°C for 1 hour revealed a small amount of calcium carbonate, CaCO3 (aragonite), and a larger amount of CaO (quicklime).

Based on the flotation tests performed using the CaO from the paper sludge to determine the pH, we can conclude that it is best to work with the Z-11 collector, and the grinding time should be reduced

to prevent the formation of galena slimes. The pyrite depressor should be changed, and the conditioning time for this reagent should be increased.

Based on the results, we can conclude that the mineral with the best recovery was covellite, and the mineral with the lowest recovery was galena.

Therefore, it is confirmed that the paper sludge is used to form CaO, and this lime can be used in mineral flotation tests; in other words, the lime becomes a byproduct.

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Sustainable University Communication: A Biomimetic and Relational Approach to Institutional Strategy

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Introduction

Social reform in response to global issues, such as climate change, gender inequality, and institutional fragmentation, is urgent, and universities must be part of the change. These needs have driven the formulation of sustainability policies that extend beyond infrastructure and curriculum to encompass governance, equity, and community engagement (Tilbury, 2011). Despite this, institutional communication is a crucial component of this change that is often forgotten. Communication is not just seen as a means of conveying information; it is also viewed as a critical practice for institutions to establish their identity, engage with their surroundings, and promote environmental sustainability (Habermas, 1987; Craig, 1999). However, to make a meaningful contribution to sustainability, communication in universities must be more than a technical function or support service. It should be understood as a deeply relational, ethical process—one that facilitates inclusive dialogue, mutual recognition, and shared understanding. This shift challenges the dominant communicative paradigms, which are grounded in efficiency, control, and unidirectional messaging. Theories such as Habermas's communicative action and Freire's pedagogy of dialogue offer helpful guidance, positioning communication as a pathway to justice and co-responsibility (Habermas, 1987).

This paper presents a paradigm of institutional communication based on the principles of living systems. Inspired by biomimicry, it utilizes nature's collaborative techniques to address intricate challenges (Benyus, 2002). Underground fungal networks in forests promote collaboration and resource sharing among trees. Universities can establish communication systems that are decentralized, adaptive, and responsive to their contexts. These networks, rather than being chaotic, exhibit a structured dependency and mutual learning. Simultaneously, higher education is transforming its understanding of knowledge and its societal role. The increasing focus on epistemic and spatial variety signifies a profound expectation for universities to recognize various modes of knowledge and engage more intimately with the communities they serve (Sousa Santos, 2009). The Sustainable Development Goals (SDGs) have forced organizations to think about sustainability in a more complete way, encompassing policies, lessons, and ways of life (Genç, 2017). Communication is key for bringing together institutional stories and expressing public promises in this changing environment (Tilbury, 2011). Despite this potential, several universities continue to view communication only as a business tool, prioritizing appearance above substance, thereby limiting their transformative capacity. The study presents a biomimetic framework comprising four stages: mapping communicative silences, co-creating institutional narratives, evaluating symbolic interconnection, and enabling feedback loops for transformation. The aim is to redefine communication as a dynamic process—crucial for institutional sustainability, responsive to diversity, and grounded in ethical principles.

As a result of this research, a situated communication management model is offered, aimed at strengthening university sustainability through the shared construction of meaning. The model is

derived from the operationalization of the theoretical principles outlined in the methodological design, which translates into a tool that enables the identification of critical points in communication processes, the activation of institutional listening mechanisms, and the reorganization of narratives based on criteria of inclusion, equity, and contextual adaptation. The proposed tool allows higher education institutions to identify critical knots in their communication practices, activate institutional listening processes, and reorganize their narratives based on criteria of inclusion, equity, and contextual relevance. To achieve this, a methodological structure was developed, comprising four main phases, each with specific products, associated qualitative instruments, and direct alignment with conceptual dimensions derived from the methodological framework.

1.- Phase of mapping communicational silences: This foundational phase focuses on sympathetic observation—the capacity to see symbolic, relational, and spatial signs of exclusion or invisibility in institutional communication (Rácz *et al.*, 2011). This serves as a preliminary assessment of the university's communicative framework, aiming to identify the unarticulated, unrepresented, or overlooked elements. The analysis delineates gaps as structural indicators of relational imbalance, employing methodologies such as content analysis, digital channel assessments, and exploratory interviews. This phase is centered around four guiding inquiries: Which actors, themes, or regions are lacking in institutional channels? Which voices have been consistently overlooked in official narratives? Are there communities that do not identify with the institutional narrative? What are the gaps impacting organizational cohesion? The result is a Map of Silences that organizes and classifies exclusions, establishing a key basis for reconstructing more inclusive, egalitarian, and contextually relevant narratives that accurately represent the variety of the university community.

2.- Narrative Co-Diagnosis Phase: This phase centers on *narrative co-diagnosis*, a process where meaning is co-constructed through the interplay of multiple relational perspectives (Mashingaidze, 2014). It emphasizes communication as a collective interpretive practice, integrating diverse voices and expressive formats—verbal, visual, affective, and cultural—to rebuild the institution's symbolic memory from a pluralistic and emotionally grounded standpoint. The goal is to generate a holistic understanding of how university communities perceive and reinterpret institutional communication. Methods such as focus groups, social mapping workshops, and open surveys enabled inclusive participation across heterogeneous actors. The following four guiding questions structured this phase: (1) How do communities perceive and experience their relationship with institutional communication? (2) What emotions, memories, or affections arise from organizational messages? (3) What knowledge forms have been excluded, and how can they be integrated? (4) What tensions or contradictions exist in shared narratives? The outcome is a Communication Perceptions Report, which captures these collective insights and highlights areas of narrative dissonance and symbolic exclusion for institutional reflection and reform.

3.- Phase of application of the operational evaluation matrix: This phase is based on the dimension of symbolic interdependence, which recognizes that every communicative act modifies the web of meanings that shape an organization (Gorzelak *et al.*, 2015). The operational matrix allows for the evaluation of coherence, inclusivity, emotional resonance, mobilization capacity, and socio-territorial relevance of communicational practices as expressions of the institutional fabric. This approach aligns with current debates that demonstrate that strategic internal communication not only fulfills informative functions but also fosters a positive emotional culture within organizations, which in turn strengthens the sense of belonging, organizational identification, and institutional resilience (Yue *et al.*, 2020). This finding is key to understanding communication as a constitutive phenomenon, not merely instrumental, where communicational practices shape relationships between actors, impact the organizational climate, and configure long-term sustainability. Thus, the evaluation proposed in this research values the relational, affective, and symbolic impact of communication, applying a structured analysis designed based on biomimetic principles such as adaptive cooperation, reciprocity, and contextual sensitivity. The following operational matrix (Tables 1 to 5) is proposed to evaluate the

institutional communication effectiveness in sustainability qualitatively. The matrix organizes five key dimensions along with their indicators, guiding questions, and suggested qualitative methods, thus allowing for a reflective, participatory, and context-adapted application to the institutional setting.

4.- Transformative feedback phase: The final phase of the communication model, which is grounded in the principle of transformative traceability, inspired by ecological succession processes where each change leaves a lasting imprint to guide future evolution (Johnstone *et al.*, 2016). Feedback is approached as a continuous, ethical, and participatory mechanism that enables institutions to adapt their communication practices toward more just, inclusive, and sustainable forms (Löfman *et al.*, 2004). In this phase, community members are engaged as co-authors of the process through collective result-sharing sessions and narrative redesign workshops, encouraging horizontal deliberation and collaborative improvement. Key reflective questions include: What learnings emerged, and how were they shared? How were voices integrated into institutional redesign? Was participatory monitoring mechanisms implemented? Moreover, how can we ensure that feedback results in real and sustainable transformation?

This phase concludes with the creation of a Communication Improvement Plan, which reorganizes institutional strategies around the principles of narrative sustainability, equity, and relational traceability. It implements the model's four fundamental concepts—empathetic observation, narrative co-diagnosis, symbolic interdependence, and transformative traceability—guaranteeing its applicability across diverse university environments (Citton, 2017). The research ultimately advocates for a comprehensive methodological framework for university sustainability through communication, based on the novel concept of the ecology of reciprocal attention. This paradigm serves as a conduit between theoretical concepts and institutional practices, facilitating the assessment and reconfiguration of communication systems via relational and symbolic metrics. It serves both analytical and projective functions: evaluating current systems and steering them toward sustainable, inclusive, and ethically grounded futures.

Conclusions

This study introduces a new framework for understanding university communication, emphasizing a biomimetic and relational approach that aligns with institutional sustainability. The study reframes communication as a dynamic and ethical organizational process by drawing inspiration from ecological systems characterized by adaptability, cooperation, and reciprocal responsiveness. The proposed model critiques instrumental, unidirectional approaches and presents a situated methodology grounded in empathetic observation, co-narrative diagnosis, symbolic interdependence, and transformative traceability. This work presents a four-phase evaluative model and the concept of the "ecology of reciprocal attention," offering universities a practical framework for identifying, assessing, and reforming their communicational ecosystems. This model diagnoses communicational dysfunctions, including silences, exclusions, and incoherencies, while also providing strategic pathways for co-constructing inclusive, emotionally resonant, and territorially relevant institutional narratives. This study asserts that communication is fundamental to sustainability, serving not as a peripheral function but as a central organizational force that shapes meaning, cultivates belonging, and enhances resilience. The implications extend beyond the university context, offering a replicable framework for institutions committed to ethical transformation and sustainable development within complex social environments.

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The Third Space: The Key to Rescuing Public Spaces, Increasing Well-Being, And Promoting Social Development

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Introduction

Recovering public spaces is a fundamental strategy for urban regeneration and strengthening the social fabric of a community. Recovering parks, squares, and recreational areas promotes community coexistence, physical activity, well-being, and citizen safety.

Well-being refers to quality of life and is an integrated construct. Researchers such as Martin Seligman and Carol Ryff have developed models to identify these elements. According to Seligman (2019), well-being is associated with engagement, a sense of purpose, positive emotions, achievement, and positive interpersonal relationships). Ryff (2013), on the other hand, links well-being to acceptance, autonomy, growth, mastery, purpose, and satisfying relationships (Goleman & Davidson, 2018; Ryff, 2013). Thus, although each author defines well-being with their own elements, they agree that it is related to interpersonal relationships, purpose, and personal growth (Ramos & Llamas, 2025).

A community's well-being is reflected in the quality of life of its citizens, which has been measured since 2011 using international metrics such as the Social Progress Index, the World Happiness Report, and the Happy Planet Index (Ramos, 2022; Ramos & Ramos, 2021; Ramos & Llamas, 2025). In this regard, quality of life is associated with "human health and the necessity of promoting environmental education with social and community outreach" (Baldi & García, 2005, p. 2).

The relationship between well-being, quality of life, and the environment is important because the environment impacts people's behavior. This relationship is part of the field of study of environmental psychology, a branch of psychology that seeks to broaden understanding of how behavior can be influenced by a community's physical and social context. Environmental psychology also emphasizes the positive and adaptive strategies people use to cope with their environment (Baldi & García, 2005).

Environmental psychology emphasizes the importance of green spaces because daily contact with nature is considered a coping strategy (Chad *et al.*, 2021; Goleman, 2013; Ramos *et al.*, 2023). Contact with nature reduces stress, improves mood, and promotes cognitive development. It also increases empathy and the ability to concentrate, as well as long-term satisfaction (Burnett, 2018; Perlmutter & Perlmutter, 2020).

Therefore, beyond their physical form or architecture, parks, squares, and recreation areas promote well-being and serve as multifunctional spaces for social consolidation, facilitating the presence and interaction of diverse social groups. In turn, these spaces allow citizens to develop an environmental identity and build a sense of belonging (Guadarrama & Pichardo, 2021).

The objectives of this work are as follows: 1. Provide a theoretical framework to enhance understanding of the Third Space Methodology and its benefits for community well-being. 2. Present a case study of a public square in Nuevo Laredo that was revitalized and the resulting impact on community well-

being. 3. Conduct an international exploration to identify countries where research on applying the third space methodology to increase well-being is being developed.

Third Space Theoretical Framework

So… What is the third place? the third space, as defined by Vargas (2018), is a zone for the transfer of experience. In other words, it is a place temporarily or transiently occupied where moments and experiences are shared. The term "third space" can refer to the physical and psychological occupation of a territory, site, or place. Thus, parks, squares, and other recreational areas can serve as third spaces. These sites are important for sociocultural development, particularly in early childhood, when the human infant is "culturally potentiated from its psychic bases through displacements of experience" (Vargas, 2018, p. 3).

The third space also fulfills human beings' need for integral development (Oldenburg, 2013, cited in Villaseñor, 2023). While the home and workplace are generally considered the main places for human development, a "third space" is also required in the daily routine. These spaces provide the opportunity to coexist with other community members and break the routine.

What is the third place methodology?

According to Moataz (2024), the third space methodology for designing urban spaces involves identifying environments that are accessible, neutral, and pleasant for users. These spaces should foster coexistence, build a sense of belonging, and promote community interaction. Third spaces should be carefully constructed to welcome families and encourage them to return, providing an environment free of the stresses associated with work and home life. These spaces must intentionally integrate accessibility for the community, provide a comfortable space, allow for flexible use, and subtly incorporate technology without interfering with coexistence (Moataz, 2024).

In addition to the above, Serna (2017) states that a site should fulfill four fundamental human needs: living, working, mobility, and recreation. These dimensions should be considered when designing spaces to meet users' needs and plan for possible growth. Another social phenomenon that occurs in public spaces is the inclusion and exclusion of groups wishing to use the environment. However, despite any disagreements that may arise, a group always remains over time to use the space, giving it a meaning that transcends time and space (Guadarrama & Pichardo, 2021).

A successful case study is the rescue of a public square in Nuevo Laredo for sports and environmental education purposes

The third space methodology is applicable to the revitalization of public squares within urban neighborhoods. One example is the "Los Fresnos" neighborhood in Nuevo Laredo, Tamaulipas, Mexico. In January 2024, the city council delivered the square to the community. The one-hectare square has a synthetic grass field surrounded by cyclone mesh.

In February 2024, a children's soccer team was formed. Its members are between 7 and 17 years old, and they are all residents of the neighborhood. The team is called "Liga Municipal Los Goats," and it has grown from 10 to 50 members in two months.

Despite the city council's authorization and neighbors' coordination of a sporting activity, several problems arose due to the pitch's free access for a month. First, a group of young people who intended to use the space for sports did not always behave appropriately or take good care of the facilities. Thus, there was a direct conflict over the use of space during the first four months. Although there was no physical aggression, the facilities were affected. For example, the shade netting on the benches was damaged, the cyclone netting began to wear out, and garbage began to accumulate on the court.

Considering the above, several measures were taken. First, the space was officially requested through direct authorization from the municipal sports secretariat. Second, we established a direct dialogue with the young people and showed them the authorization of space. Finally, we worked on building interpersonal relationships through play. This allowed us to establish a hierarchy of respect, healthy coexistence, and adequate use of the square. Collaboration between the neighborhood's inhabitants and the public initiative has been essential in joining forces to protect the integrity of the square and prevent the misuse of its facilities. This strengthens the square as an infrastructure and provides the residents with a space that serves as an intergenerational meeting point and promotes personal growth.

To understand how the neighborhood residents perceive the use of the square for sports and the creation of the Los Goats Municipal League, as well as the impact these actions have had on their sense of well-being and family relationships, interviews were conducted with the league members and their parents. A total of 47 interviews were conducted with 22 league members and 25 parents.

The following was shared from interviews conducted with league members: in general, they all feel enthusiastic about continuing sports activities. Although 86% had played sports prior to the square's construction, the square's construction allowed them to continue playing sports. One hundred percent feel that they have improved their sports skills since joining the league. Regarding feelings of well-being, 81% said they felt happier and more motivated in general. Meanwhile, 19% said they felt tired most of the time.

Regarding family life, 63% of league members said that either their mother or father accompanies them to training sessions and games. This activity fosters family relationships and strengthens family bonds. Additionally, they mention that being part of the team enables them to make friends and socialize with other young people. It also enables them to develop positive habits and become more disciplined. Some of them report improved grades and weight loss. They feel more motivated and happier, and less stressed. Having a square in the neighborhood makes them happy because they have a space close to home.

Regarding the perception of family members, the following was found: eighty-four percent have observed an improvement in their children's academic performance. This contributes to their children's overall development. In general, parents feel that there is better coexistence within their family. Therefore, it is recommended that they continue with sports activities and family interactions. Parents commented that they have observed their children becoming more motivated to participate in various activities, including school activities. They also noted improvements in their children's coexistence with other league members and their families, as well as their children's physical health. Overall, family members who participated in the interviews are happy with the development of physical activities and the establishment of discipline among children and youth.

The results of the interviews clearly show that frequent and structured use of public spaces positively influences well-being, according to the users' perceptions. The social dynamics in the Los Fresnos neighborhood sports square in Nuevo Laredo apply the third space methodology proposed by Oldenburg (1991, cited in Moataz, 2024). It serves as a place for the community to get together and promote healthy living, sports, and values like mutual respect and discipline. According to Serna's (2017) approach, the community has redefined the space for recreation, coexistence, and informal learning of values through the soccer league.

On the other hand, parental involvement strengthens emotional bonds and promotes healthier family dynamics (Pizarro *et al.*, 2013). This coincides with parents' perceptions that they experience closer coexistence, thus strengthening the family unity and well-being. Therefore, spaces located in accessible community areas that are not being used adequately due to antisocial activity can be revitalized through structured sports and cultural activities. These spaces have the potential to become Third Spaces integrated into the lives of families in their community.

The following are the results obtained from international exploration. A literature review was conducted on the Web of Science (WoS) and Scopus databases. The information was then analyzed using version 1.6.20 of the VosViewer program. This analysis revealed the networks of countries collaborating in research and the networks of keywords used by authors.

An international study exploring the application of the third space methodology to increase well-being

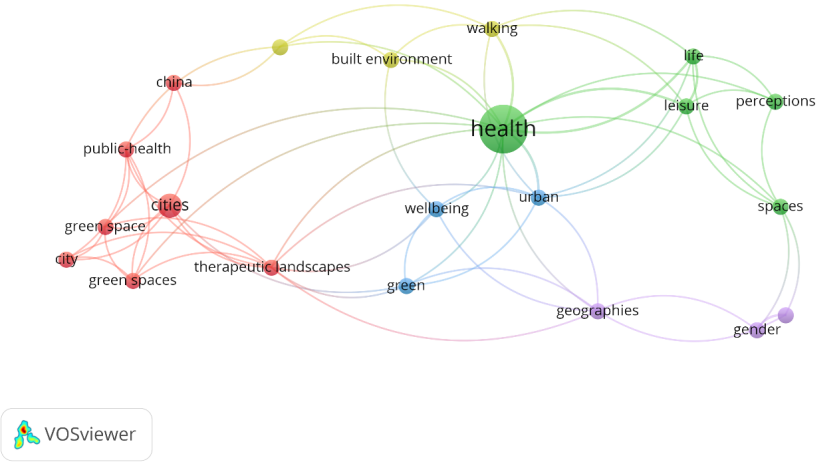
In this section, an international exploration is conducted to illustrate the collaborative networks and keyword networks of publications in two databases. Scopus and Web of Science (WoS). The selection of these databases was predicated on the assumption that the journals indexed in WoS and Scopus are typically subject to meticulous editorial evaluation processes. This approach is intended to guarantee that the studies under consideration adhere to rigorous scientific standards.

International exploration of third space and well-being in Web of Science

Figure 1 illustrates the keyword analysis, a total of 182 keywords used by the authors were examined.

Figure 1 shows the keyword network elaborated with the 21 words that appeared at least twice.

Figure 1. Keyword Networks (WoS)

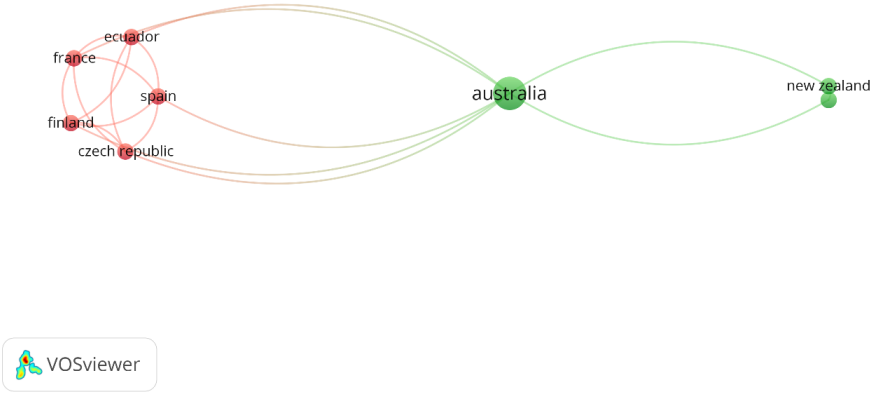


Source: Original work using the VosViewer 1.6.20 program.

The keyword network consists of five nodes. The first node consists of seven keywords: China, countries, cities, green spaces, green space, public health, and therapeutic landscapes. The second node is composed of the following keywords: health, leisure, life, perceptions, and spaces. The third node includes the keywords "green," "urban," and "well-being." The fourth node is composed of environmental construction, physical activity, and walking. The fifth node is composed of gender, geographies, and intersectionality. Of all the keywords, health has the highest frequency at 6, followed by cities at 3, and all the others at 2.

Regarding the network of countries where research on the methodology of third space and well-being. Figure 2 illustrates that the research was conducted in 18 countries: Australia, Canada, Chile, the Czech Republic, Ecuador, England, Finland, France, Germany, Ireland, New Zealand, Norway, China, Qatar, Romania, Scotland, South Africa, and Spain. Only eight countries have collaborative networks. The network consists of two nodes: one confirmed by Australia, New Zealand, and Scotland, and the other by the Czech Republic, Ecuador, Finland, France, and Spain.

Figure 2. Networks of Countries Collaborating in Research Development (WoS)

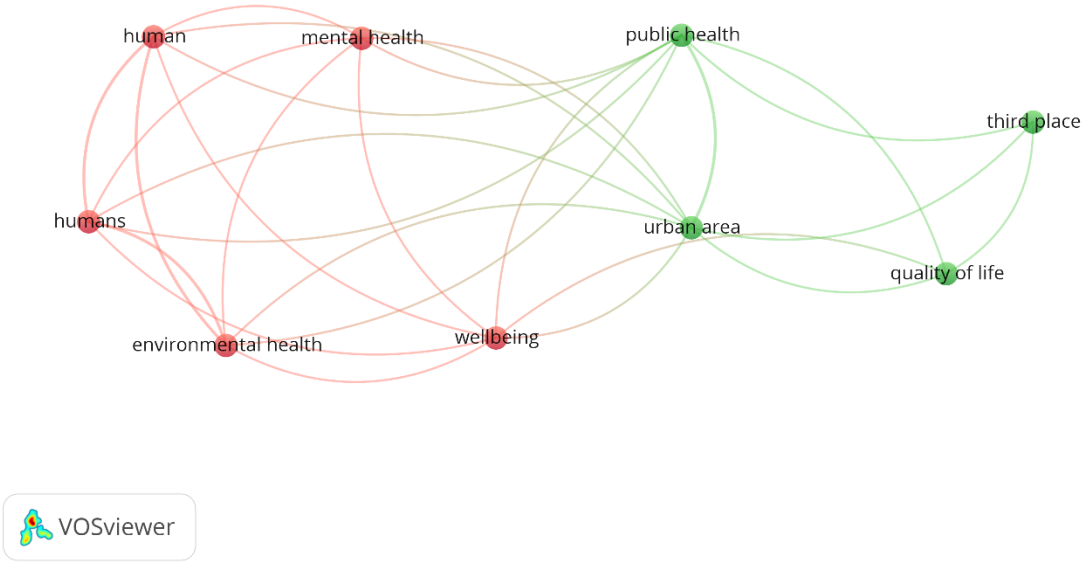


Source: Original work using the VosViewer 1.6.20 program.

International exploration of third space and well-being in Scopus

The analysis of the Scopus database examined 99 keywords used by the authors. Figure 3 shows the keyword network elaborated with the nine words that had a minimum concurrence of two. The keyword network is composed of two nodes. The first node consists of environmental health, human health, mental health and well-being. The second node consists of the keywords: public health, quality of life, third space, and urban areas.

Figure 3. Keyword Networks (Scopus)



Source: Original work using the VosViewer 1.6.20 program.

Regarding collaboration networks, it should be noted that research on the application of the Third Space and Well-Being Methodology is being conducted in twelve countries: Chile, China, Germany, Singapore, South Africa, Zambia, Belgium, Greece, the Netherlands, Norway, Qatar, and the United Kingdom. While two international collaborations were identified: one between Chile and Germany, and the other between China and Singapore, the VosViewer software does not provide an image in which such networks can be appreciated.

Conclusions

The Third Space Methodology involves creating or reusing spaces that are freely accessible, neutral, and pleasant for community members. The benefits of applying the third space methodology include increased well-being because inhabitants can strengthen or develop a sense of belonging in their community. It also improves interpersonal relationships by increasing social interactions stimulated by the space. This healthy coexistence allows communication between members of the community to increase and improve. Members are encouraged to take an interest in their neighbors, get to know them, and create bonds. This also contributes to strengthening the social fabric.

This methodology can be implemented by revitalizing public squares located within urban neighborhoods. One challenge of its application is the common misconception that spaces must be created from scratch?, when this is not always the case. Sometimes, cities have unused public spaces that can be converted into third spaces where the community can go to relax and escape their work and domestic routines.

Thus, this third space can be used to develop different types of activities that promote social development and the well-being of the inhabitants. Some examples of these activities are sports. For instance, in the city of Nuevo Laredo, a square was rescued and used for soccer training. This resulted in the formation of an official neighborhood league, which received recognition from the city council a year after the square was rescued. Other activities that can be promoted include environmental education and sustainability initiatives, such as reforestation, recycling, and maintaining green spaces, as well as cultural activities, such as painting, music, and other artistic expressions.

Therefore, applying the third space methodology to rescue public spaces fosters community cohesion by generating a positive social environment. Implementing sports activities as part of the public space activation strategy is an effective way to promote healthy lifestyles and rebuild the social fabric. It also promotes values of coexistence and offers alternatives for the integral development of children and youth.

Through international research, it was found that both the Web of Science and Scopus databases have published studies on the application of third space methodology and its impact on well-being. Web of Science has a greater volume of publications and inter-institutional collaboration networks than Scopus. Another finding is that both databases published research conducted in seven countries: South Africa, Germany, Chile, China, England, Norway, and Qatar. However, it is noteworthy that only three Spanish-speaking countries participated in this research: Chile, Ecuador, and Spain. Of these countries, only two are from Latin America. This highlights the need to explore applying this methodology in Spanish-speaking countries, especially, those from Latin America.

Some of the study's limitations are related to the current use of the third reclaimed space. While this type of space allows for a variety of activities, in the specific case analyzed in this study, the recovered square is used exclusively for sporting activities. Another important limitation is that it was not possible to establish a dialogue with all the users of the space, which could have enriched the results obtained.

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Generative Narratives and the Construction of Identity, Impact on Gender Inclusion in Engineering Careers at a Private Chilean University

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Introduction

Currently, the consolidation of more equitable societies largely depends on the critical analysis of how these are built and sustained through complex and multidimensional processes, which are determined by the transmission of beliefs, culture, values, and knowledge that redefine social dynamics (Mercado, 2012). In a global context, inclusion and diversity are essential components that shape interpersonal interactions, as they are integral to socialization processes. These dimensions are significantly relevant in the field of higher education, since it is, par excellence, the space where collective knowledge is built and learning is shared in favor of social development (Becerra Sepúlveda, 2021; Sung, 2014). Conceptualized by Erikson (1950), generativity refers to the concern that individuals have in the adult stage of their human development to establish and guide the next generations, which is why it has been studied in the transmission of knowledge and is a central element in the Construction of sociocultural legacies (Sandoval-Obando & Zacarés-González, 2020). It is understood, then, that generativity is consolidated to the extent that personal and community dimensions converge and interrelate, allowing these legacies to transcend and ensure their continuity.

In tertiary education, generative narratives, expressed in stories and testimonies shared by peers and teachers, are constituted as a tool for developing professional identity, as they configure identity, aspirational, and symbolic models that serve as a subjective and diverse reflection of one's own identity (Cuadra-Martínez *et al.*, 2021). Moreover, these narratives not only strengthen the sense of identity but also serve as elements of cultural cohesion, shaping their collective identity while factoring in the processes of social adaptation (Weststrate *et al.*, 2024).

In this context, the present study aims to analyze the extent to which the generative narratives of women in engineering affect the configuration of their professional identity and the promotion of the values of inclusion and gender equity in engineering careers. For this purpose, a qualitative approach was chosen, based on the case study methodology at the private Chilean University Bernardo O Higgins. The analysis of thematic and narrative coding allowed the identification of recurrent patterns that show significant trends in the experiences shared by female academics and their students and that offer valuable inputs for the analysis of the configuration of professional identity and sense of belonging, despite the masculinized cultural barriers that predominate in the STEM disciplines (science, engineering, mathematics and technology).

Generativity as a social construct and its basis in education

Generativity is the seventh stage of human development according to Erikson (1959). It is a multidimensional process that considers elements of leadership, self-care, creativity, and the

transmission of culture; therefore, it has a significant component in the relationship that individuals establish with their environment. According to Erikson, the life cycle of human development is composed of both biological and psychosocial elements. Both are determined by the contexts in which people are formed and develop, that is, by their culture and social interactions. Of the 8 stages of development established by the author, the seventh is generativity versus stagnation, which is distinguished by precise dimensions, such as: 1) The dimension of caring for others, 2) the dimension of production related to the creativity of the human being, and 3) The dimension of transcendence.

And finally, the dimension of civic and social sense. These dimensions are manifested in "generative actions" where people seek to contribute to the well-being of the younger generations actively. This generates a developmental tension, which is made explicit in the conflict of overcoming "stagnation" and advancing in forms of psychosocial maturity that allow the individual to overcome his individualism and overcome his ego. It depends on the capacity of each subject to grow in personal fulfillment or to limit him/herself in it (McAdams & de St. Aubin, 1992).

Overcoming this stage is achieved when people assume active roles for the benefit and care of others, which translates into generative actions that involve leadership and the donation of themselves, their time, work, skills, knowledge, beliefs, values, and culture to the next generations (Villar, *et al.*, 2024). The generative teaching practices, specifically, are presented as a way of operationalizing this development within the margins of an educational context, as part of social interaction and the sense of community life. This is how they develop ways of teaching, values, and build a sense of belonging in their students, which encourages the integration of their students in the formative processes (Sandoval-Obando *et al.*, 2022a).

Highly generative teachers draw lines of meaning that allow them to communicate their knowledge from the resignification of their own vital and personal experiences. This is evidenced by the promotion of a formative environment that fosters critical thinking, dialogue, and the valuation of students' own experiences. In other words, teaching is an intrinsically generative action, since it implies carrying out training actions for the benefit of others (Zacarés *et al.*, 2022).

Ethical and social dimensions of teaching from the perspective of generativity

Generativity, as an aspect of individual development, contributes to social welfare by generating scenarios and contexts where people are encouraged to develop their full potential, establishing meaningful bonds of care, training, and protection. Additionally, it implies a social interest in guiding others, which in the field of education forms the basis of its purposes (Zacarés *et al.*, 2022).

In addition to the above, generativity seeks to consolidate the common good by establishing bonds of acceptance and respect as a constitutive part of the teaching work, as it is expressed in the ethical work of training and guiding future generations, leading them to their integral development. From this perspective, teaching assumes a sense of transcendence, which is concretized in actions such as accompanying others in their life trajectories, through services like mentoring and training courses that leave a lasting legacy, fostering intergenerational solidarity (Villar *et al.*, 2024).

Generativity and educational inclusion in STEM areas, in the Chilean context

In the Chilean context, the integration of women in STEM (Science, Technology, Engineering, and Mathematics) areas has historically been attributed to complex sociocultural exclusion issues. An example of this is the results obtained by the Gender and Diversity Observatory of the University of Santiago de Chile (USACH), which show that out of 10 students studying these careers, only 2 are women (USACH, 2025).

On the other hand, in 2020, 55% of higher education enrollments in undergraduate careers were occupied by women; however, only 24% of them entered technology careers, while 47% pursued studies related to the basic sciences. Specifically, in careers with a high mathematical component, such as physics, engineering, and computing, female participation is below 25%. Another noteworthy phenomenon is that between 2009 and 2020, there were high dropout rates in STEAM careers.

According to a study conducted by UNESCO (2019), figures reveal significant gender inequalities in female participation in STEAM careers, indicating that only 35% of female students in higher education opt for these areas, and that only 3% of them prefer to study technology-related careers. Regarding research training, figures show that only 29.3% of researchers worldwide for that year were women, while in the years 2021-2022, this figure rose to 33% (UNESCO, 2022). In terms of applications to research competitions such as the Fondecyt Regular in STEM careers with high mathematical requirements, the percentage is 20% versus 35% in careers that do not require this requirement (Canales *et al.*, 2021).

The integration of women in the engineering sciences, analysis from the Educational Model of the Universidad Bernardo O'Higgins

For Universidad Bernardo O'Higgins (UBO), integrating women into the areas of engineering sciences is a commitment and a challenge that reflects the institution's desire to advance gender equity. Its Educational Model places as its guiding principles the "respect for the dignity of persons", understanding that education is a right inherent to the condition of every human being. This is made explicit in its Formation Model, which states that: *"The University promotes in its academic community to accept and coexist with the differences of each person, in such a way that they can feel dignified and free, in a framework of mutual respect and tolerance" (UBO, 2024).*

In the same way, UBO seeks to form professionals with a high spirit of service, which should be manifested in their professional practice to contribute to society. According to *"The Universidad Bernardo O'Higgins trains graduates and undergraduate and graduate professionals committed to freedom, order, perseverance, merit, the spirit of service and the ethical sense of O'Higgins thought... contributes to the progress and sustainable development of the country, generating and transmitting knowledge through educational, research and cultural processes committed to quality, innovation, technologies and linkage with the environment" (UBO, 2024).*

In terms of inclusion, UBO has determined as one of its development priorities, the establishment of gender equity and inclusion, especially in STEAM areas, which is evidenced by specific data such as the increase from 33% to 48% of female enrollment in careers such as Civil Industrial Engineering, from 12% to 13% in computer science careers in 2024. (Admission UBO, 2025). In this way, UBO integrates its inclusive institutional culture into its work, in an integrated and transversal manner, directly connected to its educational Model in its academic dimension. It states:

The University transversally promotes diversity, inclusion, equity, coexistence, and respect for the environment, recognizing that the interconnection between social and environmental welfare favors the availability of opportunities and resources for future generations (UBO, 2024). This background is made explicit in its Model, where the transversal axes that support it are described, namely, the axis of integral formation, which promotes the development of transversal skills in the disciplines, the axis of internationalization that integrates intercultural and international approaches and experiences, the axis of social commitment, related to sustainability and social contribution and responsibility, all from the curricular development, based on results and support to students and academics (UBO, 2024).

The results obtained from the interviews reflect the perceptions and experiences of the students, allowing us to study their motivations and interests, as well as to identify the opportunities, challenges, and barriers they have encountered in their formative trajectories and must face in constructing their

professional identity. Among these factors, aspects related to inclusion and equity in the academic context in which they develop stand out and are revealed in the following thematic coding:

Concept 1: Motivation in career choice, the interviews reveal that of the total of 22 women, 10 explicitly evidence their career choice as being driven by affinity with one of these three areas: technology, programming, or mathematics. *"I like technology and mathematics, and it is a challenge since they always say that is for men and that is not true." "I was motivated by my interest in computer science, in learning how it works, being able to create innovations." "I have always liked mathematics, so I was determined all the time to some engineering.*". Another 9 responses refer to the choice because it involves breaking social gender prejudices and stereotypes. "*The truth is that being a woman in this type of careers is a challenge, but at the same time a pride, it is good to end stereotypes and to be able to encourage more women." "It motivates me to break the barrier that exists about engineering and years of work experience." "Being a woman in this discipline is to show that caring for the planet has no gender, but a lot of strength, conviction and science."*

On the other hand, 3 participants, state that it is a "pride" they make a social difference in these disciplines. *"For me being a woman in this career that is mostly taken by men makes me feel quite proud of myself." That* is, the answers arise from the combination of disciplinary as well as personal interests in overcoming gender barriers. *"I am motivated by the desire to surpass myself and be successful, being a woman in this discipline for me means overcoming."*

Concept 2, Construction of professional identity and social impact, the themes of analysis associated with this concept are related to the sense of leadership, ethical commitment and university social responsibility. 18 responses mention terms such as "committed", "dedicated", "desire to contribute to society". o students refer to being "responsible" and "organized". 13 responses include the phrase "generate a positive impact" Students relate their identity to these values because they seek to be agents of change. *"I would consider myself a good leader, with great ideas and motivations." "I see myself as a committed professional, empathetic and oriented to find solutions that generate a positive impact". "I would like to be part of innovation and learning. I would like to be part of a change where technology is a place that includes all people."*

Concept 3, Gender Leadership and Professional Ethics 12 responses point to gender leadership skills, specifically "leading teams" as a form of female empowerment. *"Being a woman in a historically male-dominated field has pushed me to develop a resilient attitude." "I feel it influences in a challenging and motivating way." "My gender has influenced my professional identity by confronting stereotypes and challenges that have made me stronger and more determined."*

7 mention capabilities such as flexibility, adaptability, ability to learn in diverse contexts and is linked to a multifaceted way of exercising leadership in project management. "*In group work, I have found myself very responsible and taking the lead from time to time, that gives me the confidence that I am capable." "It could be emphasized that I always take the leadership role, since as a woman one has more responsibility and wants to deliver things on time and not at the last minute." "I see myself as a strategic and adaptable professional capable of making decisions and bringing value to some organization." "I visualize myself as a computer engineer of integrity, with strong ethical values, committed to continuous learning and passionate about technology."*

Concept 4, meaningful and innovative learning experiences, was used by 9 participants, who employed the term "innovate." Others mentioned concepts such as meaningful and continuous learning, continuous growth, and new ideas as factors linked to their professional identity and their role as future engineers. *"And being a woman in a mostly male environment, I also feel that my professional identity is marked by the desire to open spaces, to make capabilities visible, and to contribute to a more diverse and inclusive engineering."* There is also an interest in experiencing significant learning that transforms classroom dynamics. To this end, they emphasize the need to overcome their own limitations and develop capacities that enable them to connect technical

knowledge with the social needs required by their careers. *"It has been enriching to apply what we have learned in real situations. The most significant learning is when you can see that what you do helps to solve concrete needs of the environment." "Since I entered the career, I had the idea of doing my internship in social housing (...), when this opportunity presented itself, I did not hesitate to take advantage of it. For me, civil engineering is not only a professional career but a tool to improve people's quality of life. All this causes a positive impact on the quality of life of many people at the same time, and I find that a nice feeling."*

Concept 5, Generative Narratives and Feminine Teaching and Legacy Generative narratives are pointed out as an element of motivation and resilience in the face of social prejudices, promoting self-affirmation based on the professional life testimonies of their female teachers. These stories are recognized by 19 of the 22 interviewees as a direct source of motivation that has helped them overcome the difficulties inherent to their formative process in contexts highly dominated by masculinities. "*Very important since the head and career professor cares about each one of us as if we were her children... in the career there are more men than women and the fact that the career head is a woman delighted me and inspired me a lot".*

"The professor (...) inspires me to be an admirable professional; she makes me want to be the best of all and to stand up for myself. "A teacher who has played a very special role in my training is the professor (...). She shows genuine affection for each student. I remember that, at the beginning, she felt many doubts and insecurities for being a woman in such a demanding and mostly male career. Professor Inés was always there, worrying about how we felt, listening to us and motivating us with words full of warmth and confidence." "Female teachers have played a very important role in my training. Seeing them lead classes with confidence and technical mastery has given me a real example that it is possible to occupy leadership spaces being a woman... that trust placed in them marked a before and after in how I see myself as a future professional."

Concept 6, Challenges and Opportunities for Women in Engineering 17 of the 22 students affirm that the vision of today's society regarding engineering careers is "typical of men" which generates questioning and doubts regarding validating and demonstrating their abilities to be considered in this type of training. *"The main one is that people tell you that it is for men, but it is not true, we all can".*

"One of my main challenges is to be underestimated". They also claim to be a clear minority, which makes it difficult for them to generate networks among themselves. "There is no student community of women engineers in the university, I have seen that there is in health areas, but not in this one". "As I am just starting my first semester, one of the challenges I have felt is to adapt to an environment where most of them are men". They also refer, 13 of them, to feeling pressure to stand out among their male peers. "One of the challenges has been dealing with the idea of having to 'prove' more than others to be taken seriously."

"Sometimes I feel like I have to try harder to have my ideas taken into account." "Being few women, most of the work has to be with the rest of your peers, which is sometimes difficult...thanks to that I have taken on the role of leader." 8 mentions highlight the respectful treatment, even though stereotypes arise in it. *"I have a friend who was 'surprised' because I know more than another colleague and even commented on it, which in itself was a compliment, but I think that because I am a woman, it probably surprised him more than anything else."* As opportunities, 11 mentions refer to having support centers that favor their self- esteem and generate collective strength to overcome these barriers. *"The teachers and classmates support us and we know that we are also going to make it." "Their support helps me to continue and not give up, they make me feel confident and that I can do it."*

The analysis of this research is based on a comparative and critical review of previous research related to the topic of generativity in education from an inclusive approach. From the theoretical constructs, the proposal on the stages of human development proposed from the concept of generativity as part

of them (Erikson 1950) is essential. This framework of analysis confirms what was pointed out by the students who identify their teachers as fundamental elements in the transmission of knowledge, values and vocational purpose. This is consistent with what (Sandoval-Obando, *et al.*, 2022a) points out insofar as they refer that generativity favors professional growth and contributes to self-education. It promotes a sense of residence and relevance in their students.

From the analysis of the value of generative actions, it is evident that the findings are related to the teaching legacy (Sandoval-Obando, *et al*. 2022b) since pedagogical practices and accompaniment are part of the life experiences of educators, which promotes the sense of belonging and the transmission of values and culture. On the other hand, with respect to the transmission of cultures along the lines of female empowerment, the students who identify the legacy of female teaching figures as a leadership model, align themselves with the concepts of ethics, self- care, creativity described by Erikson and deepened by Villar, *et al*.

Conclusions

The present study demonstrates that generative teaching narratives in female leadership exert a significant influence on the identity configuration of their students and on their promotion in engineering careers. It is also concluded that accompaniment and life narratives generate a sense of belonging and promote resilience in the face of the difficulties faced by female students in traditionally masculinized training contexts. From the experience of the Universidad Bernardo O'Higgins, it is shown that the institutional actions and its Educational Model, show concrete actions focused on promoting inclusion. It also shows the need to establish daily strategies to ensure the integration of its Educational Model, in favor of gender equity in all areas of their training, especially in STEAM.

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Artisanal intelligence and community innovation using natural Totora fiber

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Researching, teaching, and creating alongside the community allows us to rediscover totora as a bridge between humanity and nature—an experience we continue to share within Academia

Introduction

In nature there are fibers of mineral, vegetable and animal origin that have been used since ancient times in both vernacular and eclectic constructions. With technological advances, fibers have been integrated into modern and contemporary construction systems, including non-traditional materials that contribute to cultural conservation and ecosystem protection. Therefore, this article examines the sustainable application of the aquatic plant called totora reeds in Latin America (Heiser, 1978), whose scientific name is *Schoenoplectus Californicus*, family Cyperaceae (Macia, 2000), which has grown for millennia in harmony with the indigenous communities of the Otavalo canton, in the province of Imbabura, Ecuador. In the Andean wetlands and lagoons of temperate climate, this plant, also called reed of various sizes (Aza, 2016) or *espadilla* in Europe (Mallison, 2010), is an integral part of the natural and aquatic ecosystem of the basins of Lake *San Pablo*, known by the *Kichwa* community of the Highlands as Laguna *Imbakucha*.

Totora is vital role in Andean aquatic ecosystems, flourishing in wetlands that support hydrological regulation, water purification, and the preservation of local biodiversity, thereby creating a symbiotic relationship between cultural practices and environmental conservation. For over five centuries, totora has been used as a construction material for dwellings and boats, with the ability to create floating islands (Jara, 2018). Its versatility makes it a sustainable alternative with significant applications in textile engineering and mechanical reinforcement (Culcay, 2014). This fiber contributes to sustainable development (Jara *et al.*, 2024) by redefining construction technologies and reducing reliance on the 30% of the Earth's surface still covered by forests (FAO, 2016), addressing the annual loss of 13 million hectares of forest (WWF, 2016) and the desertification of 3.6 billion hectares of land (WWF, 2017). The applications is traced along a historical timeline, referencing the work of Mardorf (1985), who describes this fiber as having a porous internal structure composed of micro air chambers that provide remarkable flexibility and a soft, spongelike texture. Visibly, it exhibits a smooth, uniform fibrous layer. Due to its low thermal and acoustic conductivity, it has been examined as a potential insulating material, These characteristics have been further validated through tests conducted using Zwick Roell equipment, which confirmed its resistance to weathering, maintaining internal moisture levels between 12 and 15 percent. This performance is associated with its average density of 280 kilograms per cubic meter and a variable thickness ranging from 3 to 7 millimeters (Aza, 2016).

The choice of reeds as the main material was also influenced by several sustainability-related criteria, considering environmental, social, and economic aspects focused on sustainable communities. The experiences described encouraged the participation of artisans, professionals, and others interested in these methods of manufacturing and building with totora This approach aligns with the indigenous community, which collaborates through *minga* or collective work, as their knowledge and techniques are best understood through the daily practice of their crafts. Sustainable fiber harvesting includes angled cuts 10 cm above water to allow regeneration, rotating zones to prevent overuse, and

harvesting during the waning moon to enhance the material's strength and durability, following ancestral knowledge. These techniques were validated by ecological monitoring in experimental plots, comparing biodiversity and the regeneration rate in traditional harvest areas versus areas without intervention (Jara, 2018). The totora, an ecological plant resource, has been the subject of ethnobotanical studies in Ecuador and Peru (Macía & Balslev, 2000; Banack *et al.*, 2016), where its ancestral use and Indigenous management have been documented by Paredes & Hopkins (2018), highlighting the persistence and adaptability of traditional knowledge. Its conservation and cultivation have been recorded as sustainable strategies in wetlands (Mallison & Thompson, 2010; Terneus, 2017). At the morphological level, its internal architecture has been analyzed by Corsino *et al.* (2013) and Cosme Mejía *et al.* (2017), who examined its mechanical behavior under tensile stress, corroborated by researcher Hidalgo-Cordero *et al.* (2018), who investigated its chemical composition by distinguishing between the inner pith and the outer cortex, as well as its pressed fiber structure and durability (Hidalgo-Cordero *et al.*, 2019).

The studies of Hidalgo-Cordero *et al.* (2018), Hýsková *et al.* (2019), and Jara (2018) synthesize two decades of research on totora-based construction, identifying woven panels as a sustainable alternative to conventional wall materials. A prototype developed by UNACH (2020) showed a significantly lower carbon footprint than brick or cement. If 10 percent of new rural dwellings in Ecuador adopted totora-based methods, nationwide emissions would decrease considerably. In this context, artisanal knowledge enabled a low-impact production model for composite boards, transferred between 2018 and 2024 to Indigenous artisans in Otavalo through the project "Imbabura, Territory of Innovation with Totora". As a result, these communities now manufacture totora boards and Totoraecopak, a composite that blends totora fibers with poly-aluminum, recycled plastic, and Tetrapak. Totora also holds ecological and cultural value. Ethnobotanical studies in Ecuador and Peru (Macía & Balslev, 2000; Banack *et al.*, 2016) and Indigenous management practices (Paredes & Hopkins, 2018) highlight the resilience of traditional knowledge. Its sustainable cultivation in wetlands is well documented (Mallison & Thompson, 2010; Terneus, 2017). Research has analyzed its internal structure and tensile behavior (Corsino *et al.*, 2013; Cosme Mejía *et al.*, 2017; Hidalgo-Cordero *et al.*, 2018), and its use as an eco-material has been validated in architecture and material science fields (Jara & Yanchapanta, 2018; Hýsková *et al.*, 2019). Examples of its application include Urku Wasi (Barraga, 2018), Amantica Lodge (2015), and the Totora Cube by ArchQuid at the 2016 Quito Biennial. The Technical Promoter's Manual for Construction (CONCYTEC, 2016), used in Peru, serves as a reference that promotes the use of natural fibers such as totora to improve health, thermal comfort, and resilience to climatic events. Globally, architects and researchers are developing composite materials, biomaterials, biomass-based products, and biopolymers compatible with design and detailing within academic programs at universities around the world. As this field is in constant transformation, innovation, and evolution, it continues to generate new sustainable approaches. For example, researchers at MIT recently introduced an experimental method for producing cement and other materials capable of eliminating CO2 emissions.

Figure 1 illustrates the geographic distribution of totora, this natural fiber has been traditionally used for its thermal, acoustic, and structural properties. The project highlights the development of totoracopak, a composite material made from totora, polyethylene, and recycled aluminum.

The objective was to collect traditional totora crafting methods based on its properties to strengthen indigenous artisanal intelligence through innovative material production it also aimed to explore knowledge exchange between community and academia as participatory models linking sustainability with scientific and formative research. This study aimed to document how artisans use totora highlighting its unique traits and role in creating new materials it sought to strengthen community-based knowledge by exploring sustainable uses of the fiber and examined learning and training within both community and academic spaces promoting shared innovation grounded in practice and research.

Figure 1. Totora around the world



Nota. The image features a map illustrating the geographic distribution of totora, this natural fiber has been traditionally used for its thermal, acoustic, and structural properties. The project highlights the development of totoracopak, a composite material made from totora, polyethylene, and recycled aluminum.

From Traditional Craft to Sustainable Construction

The implementation this methodology integrates two complementary approaches: a theoretical–experimental one, involving community-based analysis and workshops, and a practical one, focused on designing prototypes for future sustainable construction. In 2018, as part of applied research on the craft and architectural use of totora, the fiber was compared to more conventional construction materials and showed clear advantages. From the moment it grows, totora helps reduce the carbon footprint by absorbing CO_2 during its development. Moreover, its transformation into woven material does not require heavy energy inputs, as it is traditionally processed by hand for crafts that can be incorporated into design and architecture. Unlike mineral-based or stone materials, which cannot regenerate after extraction, natural fibers fully decompose at the end of their life cycle, leaving no long-lasting waste. Additionally, totora cultivation helps preserve wetlands, since reed beds act as natural filters and serve as key habitats for many species. It was confirmed that totora is a natural fiber with ductility, flexibility, and notable physical–mechanical resistance, making it suitable for use in construction elements such as bound rolls, where tension, diameter, and length directly affect its structural perfrmance.

Figure 2. An experimental project, a modular cattail prototype, was conducted with Universidad Politécnica Salesiana Students.



Note. Prototype showing the flexibility and structural potential of bundled totora fibers for in this study was conducted with a research team from Universidad Politécnica Salesian (Adrian Catacuamba, Samaria Jiménez, Bratt Rosero y Sebastian Ramo). The tests included specimens with variable dimensions ranging from 35–45 mm to 150 mm, with supports at 100 mm and thicknesses between 10- and 15-mm. Results showed resistance values from 0.16 to 0.65 N/mm² in shredded fibers and from 6.39 to 8.53 N/mm² in whole stems.

Totora has been incorporated into mixed structural components through the development of rigid eco-boards made by orienting and arranging its fibers with natural and industrial resins, similar to OSB wood panels. This method evaluates strength while integrating traditional totora weaving, resulting in an efficient product. These boards are used in construction for enclosures, insulation, and structural elements, and are currently undergoing patent registration. Thermal monitoring shows that buildings with totora maintain more stable indoor temperatures than conventional ones, reducing the need for artificial climate control. Acoustic tests by the *Universidad de las Américas* revealed significant noise reduction in totora-insulated walls, matching high-cost industrial solutions with a lower environmental impact. These results, published in the 2024 study "Thermoacoustic properties of four natural fibers: Musa textilis, Furcraea andina, for construction applications," have opened new research on totora and its material characterization. Handcrafted boards developed in Ecuador since 2014, using processes of immunization, thermal fusion, and adhesion of interwoven totora fibers, represent a form

of textile engineering rooted in the ancestral knowledge of communities and their traditional crafts in Imbabura Province. These boards exhibit strength values ranging from 10.19 kgf/cm² to 71.38 kgf/cm², exceeding the allowable limit of 20 kgf/cm² established by the Ecuadorian Construction Code (NEC, 2014) for wood. Tests conducted in the materials laboratory in 2017 confirmed that totora fiber is suitable for multifunctional construction applications. These rigid panels aim to achieve waterproofing and can be considered a bioclimatic material, suitable for insulation and for reducing thermal bridging within buildings designed for optimal and natural passive heating. The thermal transmittance of a construction using totora fiber in a temperate climate range from 0.40 to 0.45 W/m²K, maintaining an average indoor temperature above 18 degrees Celsius. This was applied in a pilot project at UNACH (*Minga*-Lab, 2020), which featured a modular, habitable construction system based on these fibers.

The outcome of the project Imbabura, Territory of Innovation with Totora (2014) empowered the Indigenous community to craft totora boards and *totoraecopak* for versatile use on horizontal, vertical, and inclined surfaces, flat or corrugated. This initiative advanced sustainable construction by introducing plant fiber–based materials blended with recycled inputs, within a circular and solidarity economy model. The application of high-performance adhesives—polyvinyl acetate, recycled poly-aluminum, and biopolymers—combined with various fibers, enhanced bending resistance in structural components, reaching 10 to 20 MPa in elements weighing 200 to 300 grams (Jara, 2018). Extrapolating these data to a national scale, if only 10 percent of new rural constructions in Ecuador incorporated totora-based building techniques, a significant reduction in emissions could be achieved. The feasibility of using plant fibers as a renewable raw material, along with their potential as agro-industrial byproducts, supports the development of composite boards and other derived products through the reuse of bituminous materials. Research highlights a social project that draws on local resources and the knowledge of women artisans, who are the primary keepers of this traditional expertise. They actively participate in co-creation processes that transform centuries-old practices into innovative applications. The community has developed seasonal harvesting calendars to ensure optimal regeneration of the resource, preventing its depletion. The artisans have maintained a productive relationship with the totora wetlands, developing adaptive knowledge in response to urbanization and climate change. These practices contribute to environmental conservation, collective rights, and the recognition of Imbabura as a Global Geopark (UNESCO, 2019).

In Ecuador, Peru, and Bolivia, natural fibers have traditionally been used in construction. As Vásquez (2009) states, "the act of dwelling emerges spontaneously as a human response to the external conditions that must be faced when building homes, contributing local and context-specific parameters of self-construction." Bolivia and Peru are internationally recognized for their techniques and construction methods using totora, a plant that grows extensively in the basins of Lake Titicaca. According to Hidalgo (2019), this plant can reach depths of up to five meters and produce as much as 57.9 tons per hectare per year. Artisanal intelligence is a situated knowledge passed down through generations. The weavers combine ecological, technical, and symbolic understanding, contributing to climate adaptation in the Andes and adjusting their practices over time, becoming an example of ecosystem resilience with relevance for public policy. Countries such as Mexico, Chile, France, Germany, Spain, and England, through their schools of architecture, have participated in research on plant-based, mineral, and other natural fibers, developing materials with multiple applications in contemporary architectural design, detailing, and construction.

Conclusions

Totora fiber holds significant potential for community-based construction. It is versatile and functional as an architectural element; its strength, lightness, and ductility allow for multiple applications in renewable materials. It is part of the ancestral knowledge known as Artisanal Intelligence, now validated by scientific studies providing qualitative evidence of its mechanical properties. This material has been recognized for its ductility, acoustic insulation capacity, and potential to generate fiber-

derived biopolymers useful in the production of eco-materials, which can also be characterized within biochemical and mathematical fields. These findings are rooted in the ancestral communal knowledge of *Otavalo*, referred to as artisanal intelligence. Today, this wisdom has been confirmed by the previously mentioned studies, which offer qualitative evidence on the mechanical properties of totora, published in scientific research. This research contributes to the recovery of local crafts and trades while fostering economic regeneration through the principles of a circular economy. It promotes restoration through remanufacturing, applying concepts from Industry 4.0 and integrating natural fibers into construction. It encompasses broader dimensions of sustainability. The materials derived from totora present a remarkably favorable ecological balance. Using totora in construction can reduce greenhouse gas emissions by up to 70 percent compared to traditional systems. The fiber also carries a social impact, strengthening the community economy and promoting the intergenerational transmission of traditional trades, its integration into construction systems aligns with the United Nations Sustainable Development Goals related to sustainable cities, responsible consumption, and climate change mitigation. From an environmental justice standpoint, the work with totora in Otavalo represents territorial and biocultural sustainability.

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Memories of the Earth: Gamonalism and Identities in Amantaní

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Introduction

Amantaní Island, located in Lake Titicaca in the highlands of Puno, constitutes a paradigmatic setting for the study of cultural continuities and forms of resistance against structures of domination. Its insular geography, the persistence of communal life, and a dense and complex historical trajectory have favored the preservation and transformation of ancestral practices. Far from disappearing, these practices have been re-signified as central elements in the construction of identity, emerging as a response to the gamonal regime that deeply marked rural Andean life during the nineteenth and twentieth centuries. In this context, the articulation between territory, spirituality, community, and memory has been fundamental for reaffirming the cultural identity of the people of Amantaní.

This process can be better understood from the perspective of cultural hybridity. Hybridity is a continuous dynamic that arises from prolonged contact among diverse human groups and is expressed in religion, language, music, and festivities. Such contact generates new and changing cultural forms. Hybrid identities are constructed through interaction and conflict, reconfiguring cultural belonging in spaces of encounter, while syncretic practices—such as carnivals—show how different traditions merge dynamically. These forms of expression preserve internal tensions and, at the same time, embody creativity in the face of cultural domination (Burke, 2014).

Gamonalismo, understood as a structure of economic, political, and symbolic power exercised by landowners over the peasant population, established on the island a system of servitude characterized by land monopolization, the repression of access to education, and the instrumentalization of religious festivities. In response to these mechanisms of subjugation, the communities deployed both material and symbolic forms of resistance. These were expressed in the continuity of reciprocity systems (ayni, minka), in agricultural rituals, in the daily use of the Quechua language, and in the persistence of the Andean worldview. These cultural expressions not only survived but were reconfigured as active strategies of identity defense and territorial affirmation.

This study analyzes how gamonalismo has shaped and interacted with the construction of cultural identity on Amantaní Island. It argues that cultural expressions, traditional practices, and resistance processes have negotiated with gamonal power, producing hybrid forms and strong collective resilience. The recovery of sacred spaces, such as the Pachamama and Pachatata temples (National Cultural Heritage, 2020), together with the defense of the Quechua language, oral memory, and communal organization, exemplifies a model of ritualized resistance. From a historical-anthropological perspective, these dynamics highlight collective subjectivation in the Andes and call for culturally sustainable and socially just development for Indigenous peoples in a globalized context.

Unlike Taquile, focused on textile tourism, and the Colca Valley, centered on agricultural and touristic interaction, Amantaní maintains a ritualized resistance rooted in ceremonies, festivals, language, and ancestral practices. These rituals function as symbolic forms of cultural defense and as spaces of memory and cohesion. In this way, identity is reinforced in the face of historical structures of domination.

Gamonalism, micropolitics, and geopolitics in Amantani

Gamonalismo has been conceptualized as a particular form of rural domination that combines economic, political, and symbolic power, exercised over peasant communities through control of land, labor, and everyday life. According to Flores Galindo (1986), gamonalismo represented a feudalizing form of economic power in the rural Andean space, as well as a mental and symbolic structure that articulated practices of cultural subordination in the name of Creole "progress." The gamonal, owner of vast lands, exercised his authority through clientelist mechanisms, legal and religious repression, and an economy of dispossession legitimized by the republican state.

According to Coca Vargas (2021), the gamonalista discourse invoked restoring the Tawantinsuyo to legitimize domination. In Puno, Gascón (1997) shows gamonalismo operated through land appropriation and labor subjugation, creating a self-referential local power system. The hacendado held judicial, administrative, and spiritual authority, often colluding with church and political powers.

On Amantaní Island, this control was intensified by geographic isolation, shaping daily life through micropolitical dynamics of domination and resistance among campesinos and colonos. At the same time, geopolitically, Amantaní's peripheral location and state policies like agrarian reform influenced and interacted with these local power structures. Thus, gamonalismo functions both as a localized system of power and as part of broader territorial and political frameworks, shaping collective memory and cultural identity through intertwined scales of control and resilience.

Cultural Identity and Resistance in the Andes

Cultural identity, understood as the symbolic construction through which a social collective defines and differentiates itself based on its history, territory, language, and worldview, has been extensively studied in Indigenous contexts. For Hall (1996), identity is not a fixed essence but a dynamic and historically situated construction that transforms through interaction with structures of power. This framework helps explain how Andean communities have re-signified their traditions in response to external impositions, shaping resistant identities in constant negotiation.

Authors such as Albó (2001) and Rivera Cusicanqui (2010) have deepened the analysis of Indigenous identity as a form of cultural resistance. In the case of the Andes, identity cannot be separated from the spiritual relationship with the land, communal reciprocity, and ancestral memory. These dimensions have been key to sustaining cultural forms that provide alternatives to modern development models. On Amantaní Island, the persistence of the Quechua language, rituals dedicated to Pachatata and Pachamama, and the ayni and minka systems are expressions of Andean identity. They challenge the homogenizing logic of gamonalismo and the centralist state.

Andean Worldview and Religious Syncretism

The Andean worldview proposes an understanding of the world grounded in complementarity, reciprocity, and balance between human beings, nature, and spiritual entities. This Quechua and Aymara system of thought posits an integral connection with the Apus (tutelary mountains), Pachamama (Mother Earth), and cosmic cycles (Lajo, 2005). On the island of Amantaní, this worldview remains alive in agricultural rituals, syncretic festivals, and food practices, as symbolic expressions of cultural identity.

Religious syncretism, defined as the fusion of pre-Hispanic and Christian religious elements, has served as a key mechanism for resistance and re-signification. According to García (1989), it constitutes an active form of reinterpreting colonial impositions from within Indigenous cultural rationalities. The festivities of San Sebastián, Pentecost, and the ritual offering to the Earth in Amantaní reflect this hybridity, where the Catholic calendar intertwines with the agricultural cycle and offerings to Mother Earth.

Historical Memory, Territoriality, and Communal Agency

Historical memory is another key axis in the construction of identity and resistance. According to Jelin (2002), memory is a reconstruction of the past and a form of symbolic struggle for recognition. In Andean communities such as Amantaní, the memory of gamonal oppression, uprisings, and territorial dispossession remains alive in oral narratives and rituals. It nourishes a collective identity rooted in the demand for land and justice.

Likewise, territoriality refers not only to land use but also to the symbolic dimension of lived space. In the Andean worldview, territory is body, history, and spirituality (Toledo, 2005). The communities of Amantaní reaffirm their territorial belonging through the naming of places, agricultural practices, rituals, and cultural expressions. It is a continuous exercise of communal agency that challenges the fragmentation imposed by gamonal power

Gamonalism marked the economy, politics, and way of life on Amantaní; it permeated cultural practices, communal organization, and symbolic identity. The inhabitants responded with strategies of resistance; they preserved and re-signified their ancestral culture. They articulated Indigenous and colonial elements within a logic of ayllu, reciprocity, ritual, and connection to the land. Furthermore, gamonalism manifested in territorial control, labor domination, and the denial of basic rights such as access to education. These effects persisted into the twentieth century. They can be summarized as follows:

Way of Life. Communal practices such as ayni and minka persisted during the reign of gamonalism; they reinforced social cohesion in the face of fragmentation. These practices expressed an ancestral ethic of reciprocity with the land. As Gascón (1997) notes, the dual identity of settler and ayllu member consolidated the sense of communal belonging. Land Governance and Ownership. For centuries, Amantaní was governed under a hacienda regime; local autonomy over land was denied. Beginning in 1964, community members reclaimed their territory; they achieved this through litigation and direct acquisitions. This process marked a transition toward communal and familial land ownership.

Fundamental Rights. Gamonalism systematically denied education; it feared the emergence of critical consciousness. Since 1910, residents promoted the establishment of schools; by 1935, they had secured teachers. This effort constituted a form of cultural resistance through education (Montoya, 1989). Working Conditions and Reciprocity. Servile labor implied exploitation, lack of wages, and structural violence. Nevertheless, ayni, minka, and yanapanakuy persisted; these were Indigenous forms of labor organization. These practices sustained a collective ethic in opposition to the individualism imposed by gamonalism (Matos Mar, 2007).

Crisis of the Gamonal Model. Resistance took shape in agrarian conflicts and uprisings, such as that of 1867; these were historical expressions of the struggle for land and communal dignity. They asserted the right to exist as a people and to defend a distinctive cultural project (Burga & Flores Galindo, 1987). Gamonalism imposed exclusionary structures that transformed communal life on Amantaní. Nevertheless, everyday resistance sustained work, spirituality, organization, and education. This process reaffirmed cultural identity as an active form of resistance and self-determination.

Regarding customs and cultural identity, the following expressions of resistance and identity stand out in Amantaní:

Memory and Ritual. The temples of Pachamama and Pachatata on the island of Amantaní continue to function as ritual centers closely linked to the agricultural calendar. These temples reflect a dual Andean cosmovision where the complementarity between masculine and feminine is expressed, represented respectively as Pachatata (Father Sky) and Pachamama (Mother Earth). Each temple is located on one of the island's two main peaks: The Pachatata (or Coanos) temple, a square-shaped structure, is associated with solar cycles and masculine power, while the Pachamama (or Llaquistiti) temple, circular in shape, is connected to earth fertility and lunar cycles. This duality also symbolizes the balance between the cosmic and terrestrial dimensions that supports the ancestral vision of nature and spirituality.

During festivals, the temples are exclusively opened for rituals led by Quechua priests (Tata Paqo), who perform offerings to the earth and cosmos to ensure good harvests and prevent adverse climatic phenomena, by the principle of Ayni, or reciprocity with nature. Additionally, their architecture reflects advanced knowledge of engineering and astronomy, demonstrating practical use for celestial observation and the construction of agricultural calendars (Lajo, 2005; Reinhard, 1996; Protzen, 2010). Language and Orality. Quechua, as the majority language on the island, not only structures contemporary cultural identity but also serves as the fundamental medium through which rituals, ancestral knowledge, values, and collective memory are transmitted across generations. The persistence of Quechua represents a form of linguistic resistance against the imposition of Spanish and affirms the continuity of Andean culture within contexts of mestizaje and religious syncretism (Hornberger & Coronel-Molina, 2004).

Festive Syncretism: The celebrations of San Sebastián, Pentecost, and Qhapaq Pachamama Raymi are living examples of active cultural syncretism. In these festivities, Catholic religiosity is re-signified through ancestral rituals honoring the apus (mountain spirits) and Mother Earth, expressing a cultural continuity that fuses pre-Hispanic and Christian beliefs. For example, the symbolic competitions between the groups dedicated to Pachatata and Pachamama during the festival demonstrate how the Andean duality remains alive and expresses a dynamic understanding of time and fertility, integrating Christian elements with traditional Andean cosmovision (García, 1989; Allen, 1988; Van de Guchte, 2003). Gastronomy and Territoriality. Traditional cuisine reflects the relationship between agro-food knowledge, territory, and worldview; dishes such as huatia, pesque de quinoa, and ispi thimpu express identity and hospitality. Andean gastronomy symbolizes memory, sustainability, and cultural economy (Menor-Campos et al., 2022). Adaptation and Tourism. Experiential tourism has been incorporated as a community strategy for cultural and economic sustainability; through lodging, handicrafts, and festivals, income is generated without renouncing identity. This practice helps prevent mass migration and balances tradition with transformation (Allpa, 2021).

These expressions reveal a dynamic collective identity; it resists and reinvents itself. After centuries of gamonal domination, Amantaní asserts itself as a space of Andean vitality. Communal culture endures as a way of life, symbolic resistance, and projection into the future. The results reveal a historical resistance to gamonalism in Amantaní. This resistance is articulated through Andean spirituality, reciprocity, and communal life. Quechua endures, alongside earth-offer rituals, syncretic festivities, and local gastronomy. These manifestations construct a deep-rooted collective identity sustained by active historical memory. Rivera (2010) and Lajo (2005) emphasize ritual as a political language and symbolic strategy. Practices such as ayni, minka, and patron saint festivals persist; they are re-signified as forms of cultural subjectivation and territorial defense. However, the analysis also uncovers the scars left by gamonalism. Economic inequalities and communal fragmentation are evident. Symbolic hierarchies endure in festive roles and arrange marriages (Matos Mar, 2007), warn of internal conflicts, factionalism, and ambivalence within Andean communities. In Amantaní, these dynamics appear as rivalries between ayllus and among colonos from different haciendas (Gascón, 1997). Education and tourism reflect this dual logic of resistance and adaptation. Education functions as a liberating tool (Montoya, 1989). Experiential tourism risks cultural commodification (Shepherd, 2002). Yet it also

operates as a community-based strategy of adaptive resistance (Allpa, 2021). In summary, Amantaní's cultural identity is forged through a conflictive dialogue with gamonalism. Ancestral practices do not vanish; they are symbolically reconfigured. Resistance is partial and heterogeneous. We propose the theory of Andean Ritualized Resistance. It rests on three principles: (a) ritual as a political act that re-signifies domination; (b) the community as a nucleus of counter-hegemonic cultural power and a matrix of collective subjectivities; and (c) identity as a symbolic, dynamic, territorialized construct. This framework contributes to the Latin American discourse on Indigenous resistance, integrating history, symbolic anthropology, and political theory grounded in lived communal experience.

Conclusions

The evidence confirms that gamonalismo functioned as a persistent structure of intersectional domination. Its influence transcended the economic sphere, consolidating itself as a hierarchical cultural, symbolic, and political order. It combined territorial control with educational, linguistic, and religious exclusion, colonizing both space and collective subjectivity, shaping imaginaries, and naturalizing subordination. However, the community preserved spaces of symbolic autonomy and cultural cohesion. These silent forms of resistance prevented complete colonization and allowed for a reinterpretation of history from the community's perspective. Cultural identity in Amantaní is not a remnant of the past. It is an active, adaptive, and ritualized form of resistance. Practices such as offerings to the earth, syncretic festivities, and reciprocity have been re-signified. They function as mechanisms of collective affirmation and territorial defense, articulating memory, spirituality, and communal organization. Andean ritual operates as a silent political language: it legitimizes rights, preserves social cohesion, and transmits knowledge. Thus, cultural identity becomes a strategy of integral resistance, combining symbolic continuity with community-driven innovation, reaffirming the Andean historical legacy. The community of Amantaní acts as a historical and strategic subject. It articulates cultural resistance with contemporary transformation, strengthening its identity without renouncing its development proposals. Initiatives such as experiential tourism and intercultural education represent a creative renewal of its identity matrix. Collective action dismantles reductionist visions and rejects the idea of passive communities in the face of external policies. Instead, it promotes a perspective grounded in ethno-diversity, self-determination, and intercultural dialogue. Amantaní embodies active resistance and cultural innovation, challenges homogenizing development models, and reaffirms communal life as an Andean political project.

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Sustainable Fashion with a Social and Environmental Focus in Peru: The case of the Brand Estrafalario

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Introduction

In recent years, sustainability and environmental care have become a concern not only at the public and personal level but also within organizations across all industries. Businesses aim to create or adapt their models to be more sustainable, aligning with market trends through responsible actions and environmentally conscious processes (Gwilt, 2014).

The textile industry is one of the world's most polluting sectors. In the era after globalization, media helped strengthen a consumerist behavior centered on fleeting fashion trends. Fast fashion and low-cost fashion promoted excessive production and seasonal clothing consumption, encouraging use-and-dispose habits with harmful environmental consequences (Castillo, Romero, & Gonzales, 2020).

The study "Consumer Behavior in the Digital Market Regarding Sustainable Fashion: Case Study of Spanish Influencers" reveals that implementing circular economy strategies within sustainable business models benefits not only the environment but also generates favorable economic results. This enables businesses to remain sustainable, even during challenging periods (Castillo *et al.*, 2020).

In this context, Estrafalario, a sustainable fashion brand born in Peru and led by founder Valery Zevallos, aims to position itself as a reference for sustainable fashion in the country. The main objective of this study is to analyze the challenges of environmental, social, health (Covid 2019), and political origin that the Peruvian brand Estrafalario had to face in the sustainable fashion sector in order to understand its impact on the development of responsible practices in the Peruvian textile industry, combining economic, social, and environmental strategies to develop a sustainable business model.

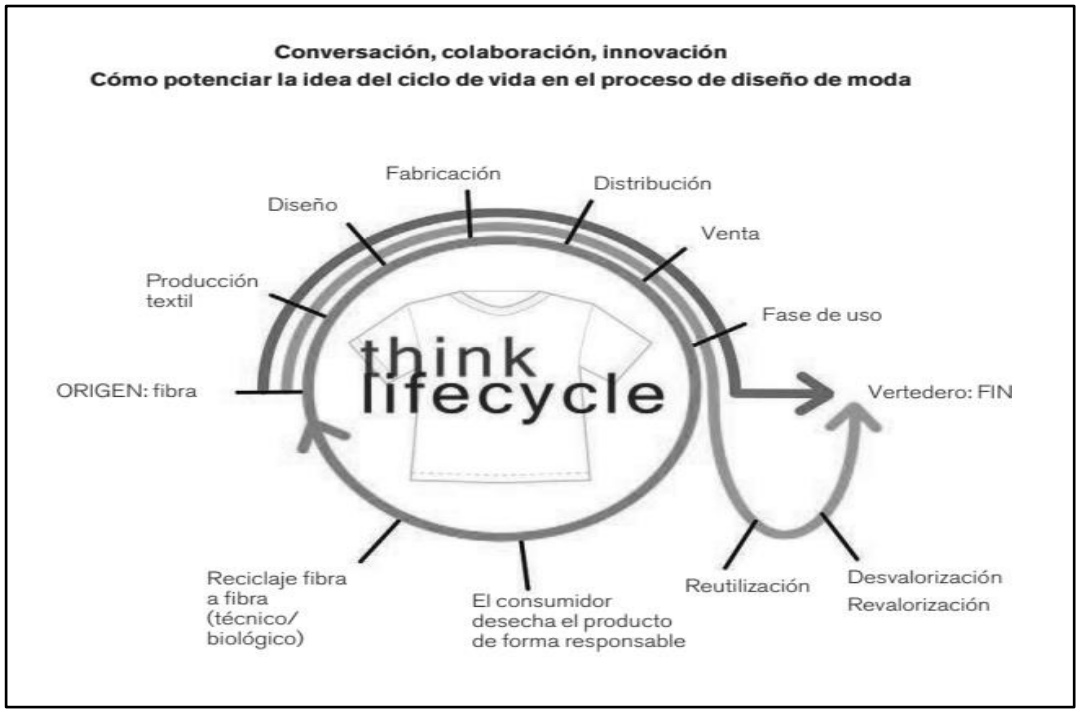
Sustainable Fashion

The fashion industry has a significant environmental impact. The UN has declared fast fashion a global environmental emergency. Over the past 15 years, global clothing production has doubled while usage time has been cut in half, resulting in a dramatic increase in textile waste with devastating effects on the planet (Corporación Unificada Nacional de Educación Superior, [CUNES], 2018).

Many fashion businesses still choose unsustainable models that focus on fast, cheap, and short-lived fashion, ignoring the long-term consequences on the environment, not only in production but also at the end of a garment's life cycle. Gwilt (2014) highlights that modern sustainable fashion considers three main pillars: social, environmental, and economic factors.

Figure 1. Life Cycle: from obtaining the fiber to its elimination

Note: Gwilt (2014)



Social focus

The connection between sustainable fashion and the social dimension lies in the concern for the well-being of those involved in the industry and society as a whole. This includes ensuring fair and safe working conditions, decent wages, reasonable hours, access to health and safety, and eliminating labor exploitation and child labor (Rocha, 2018).

Sustainable fashion also fosters employment opportunities, empowerment, inclusion, gender equality, and diversity—especially among local communities (Daukantiene, 2022). These practices not only support economic growth but also promote ethical, responsible industry standards.

Sustainable fashion drives meaningful change: it values those who produce, promotes social engagement, and encourages critical awareness among consumers. It's not just about looking good—it's about doing good. (Jerkovic & Collantes-González, 2024).

Environmental Focus

Sustainable fashion aims to reduce environmental harm through various actions: using eco-friendly materials, optimizing resource use, lowering carbon emissions, embracing circular economy models, and ensuring transparency throughout the supply chain

Canossa-Montes de Oca, (2021) emphasizes the circular economy as a key strategy. It breaks the traditional linear model of production and consumption by promoting reuse and recycling. This reduces waste, lowers resource consumption, and minimizes costs tied to raw material acquisition. Recycled or repurposed materials lessen pressure on natural ecosystems.

Circularity also opens doors to new business models, including additional services and product lines derived from production waste. With more countries adopting sustainability-friendly policies, businesses that embrace circular practices gain a competitive edge in emerging markets, expanding their customer base and boosting growth opportunities (Cosme da Costa, 2022).

Estrafalario: Sustainable Fashion

Estrafalario is a Peruvian urban fashion brand with a social and environmental focus, offering original and versatile clothing and accessories. Unlike its competitors, Estrafalario enables its customers to make a positive social and environmental impact through smart, responsible purchases.

Its business model promotes social inclusion, working with women from the Anexo de Chorrillos prison, providing not only fair employment but also technical training and empowerment. Additionally, part of the brand's revenue supports young mothers from the INABIF program.

More than 50 women have been trained and receive technical assistance as part of the Estrafalario team, earning fair wages and improving their living conditions while reintegrating into society. The brand also promotes environmental responsibility by extending garment life cycles through recycling, circular economy, and the use of eco-friendly materials.

Founder Valery Zevallos is committed to making Estrafalario a leader in sustainable fashion in Peru, particularly in response to the country's high rates of violence against women. Her work is driven by a desire to address both environmental and social issues through her brand (Fundación Wiese, 2019).

Key Milestones

Estrafalario was founded in 2010. In the same year, Valery participated in the COP21 Climate Conference in Paris, which prompted her to shift to a sustainable business model.

By 2017, Estrafalario had joined a female empowerment and employability program, working with women in vulnerable conditions.

In 2018, the brand was among the top 10 finalists for the Kunan Award, a Peruvian platform recognizing social and environmental ventures.

During the COVID-19 pandemic, Estrafalario embraced online sales, boosting its reach and increasing revenue by over 300% in 2021.

The brand innovated by launching new collections of biodegradable face masks, co-created with artisan women. Its production process included biodegradable materials, recycled fabrics, and textile waste reduction, helping the brand gain both national and international recognition.

Challenges Faced

In the face of the global COVID-19 pandemic and the economic crisis it brought to the country, the only option was to reinvent and view the situation from a positive and creative perspective, allowing for the search for new horizons before vanishing like many other companies.

Estrafalario opted for e-commerce, which, until a few years ago, was not highly regarded as it was considered unreliable. However, during the pandemic, this perspective shifted. E-commerce sales increased as it became the only available sales channel. As a result, Valery boosted her brand through digital platforms such as e-commerce and social media, increasing sales by 358%.

She received advice and funding from the Entrepreneur Fund, a program created by the Wiese Foundation. However, the pandemic required some strategies to be restructured. Nevertheless, the Wiese Foundation continued to support Estrafalario consistently (Fundación Wiese, 2019).

Regarding internal challenges, there was a need for proper administrative and operational management, as increased growth also led to increased expenses.

Social Strategies

In Peru, there is a high rate of violence against women, who often depend emotionally and economically on their aggressors. This is why Estrafalario seeks to break this cycle and transform their reality. Estrafalario works with vulnerable women, including inmates from the Chorrillos prison and young mothers from the INABIF program in Salamanca. Part of Estrafalario's work includes assessing their emotional and technical skills, providing training and support that enables them to co-create products, reflecting what they have learned through the program.

Thus, Estrafalario's social strategy is that a percentage of the products sold is allocated to these empowerment and employability programs developed by the team. Estrafalario aims to reach more potential customers, not only within the country but also internationally, so that its social impact can reach more women and improve their quality of life.

Environmental Strategies

Part of Estrafalario's environmental strategy is to apply a circular economy, recycling and using organic fabrics such as ECONYL regenerated and 100% sustainable materials—as well as biodegradable Peruvian Pima cotton, biodegradable natural linen, and deadstock, which refers to surplus from the textile industry. As detailed, Estrafalario reflects on the entire product life cycle, taking responsibility from the origin of the garment to its reuse or disposal, without generating harmful environmental effects.

The materials used in their garments are biodegradable and do not pollute the soil. Likewise, by using surplus waste from textile companies, they reduce resource consumption and the pollution generated by producing these textiles.
Another environmental contribution Estrafalario makes is that 70% of its garments are transformable and versatile, meaning the brand aims to extend their life cycle as much as possible.

Economic Strategies

Economic strategies enable the company to be sustainable over time. In the case of Estrafalario, these strategies go hand in hand with the two previous ones. By adopting a social approach, the company can collaborate with other organizations that provide funding and support for the various strategies the brand is developing. Similarly, having this funding allows them to reach more potential customers, thus increasing their sales.

On the other hand, by adopting a circular economy approach, through recycling and reuse, product costs are reduced, leading to a favorable profit margin.

Current Challenges

Valery Zevallos, as CEO of Estrafalario, seeks to sustain and increase the number of beneficiaries in the Productive Prisons program, generating employment, fair wages, and technical education for women in the prisons of Chorrillos and Fátima. The goal is to increase revenues by expanding sales channels and e-commerce in both national and international markets.

- Based on the experience that Estrafalario's best collections were developed by women from the community of Magdalena de Cao (for the Señora de Cao collection) and women from Pucallpa (for the Pucallpa collection), the current challenge is to develop new collections considering the knowledge and legacy of more artisan women, to promote textile culture, a heritage from pre-Inca civilizations in Peru.

- Implement sustainable materials throughout the entire production process, committing to continue developing new techniques and conducting ongoing research for continuous improvement. Save water, plant trees, and create more partnerships with organizations that promote environmental care (Estrafalario, 2023).

Conclusions

In conclusion, despite the challenges and uncertainty generated by the pandemic and the internal crisis, Estrafalario manages to reinvent itself, promoting its sustainable fashion brand through e-commerce and social media, manufacturing eco-friendly clothing and collaborating with social projects. Its sustainable approach and adaptability have allowed it to remain active and achieve significant growth.

Estrafalario positions itself as an example of a sustainable business model by including women in vulnerable situations in its production chain, who, with training and technical assistance, access fair wages that improve their income and quality of life.

Estrafalario demonstrates that it is possible to have a positive impact on the planet. The company has developed a solid environmental strategy, focusing on the circular economy and the use of organic and recycled materials. From the origin of the garments to their reuse or disposal, along with its focus on versatility and timelessness, it reinforces its commitment to encouraging responsible consumer purchases for environmental protection, promoting a sustainable business model.

Estrafalario has shown that it is possible to combine economic, social, and environmental strategies in a sustainable business model. Its social approach has provided the opportunity to access financing through strategic partnerships. Its environmental focus has allowed it to save production costs and reduce environmental impact, which has increased its sales by applying a circular economy approach, positioning it as a resilient company that leads sustainable fashion in Peru.

Among the main limitations of the study is the unique focus on a specific company in the sustainable fashion sector in Peru, which may limit the generalization of the findings to other companies in the sector. Additionally, the analysis period coincides with the COVID-19 pandemic, which may have influenced the observed results. Future lines of research suggest conducting comparative studies with other sustainable fashion companies in Peru and Latin America to identify patterns and best practices in the sector; analyzing the quantitative economic impact of sustainability strategies on the company's financial results; and delving into the study of Peruvian consumer behavior regarding sustainable fashion, including their willingness to pay and factors influencing the purchase decision of eco-friendly products.

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From the Classroom to Action: Effectiveness of AIoT Educational Interventions on Students' Environmental Awareness

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Introduction

The urgency of addressing ecological setbacks has led to the promotion of educational initiatives that incorporate emerging innovations, such as AIoT, into instruction on sustainability and the natural environment. In this context, it is crucial to understand how these technologies impact the ecological attitudes and behaviors of university students. Education, as a core tool in shaping informed citizens, is an area where the synergy of digital and immersive tools can potentially reshape beliefs and actions related to the ecosystem (Liu & Zhang, 2024).

AIoT, which merges artificial intelligence (AI) with the network of interconnected objects, enables the establishment of personalized and immersive teaching frameworks that could strengthen students' environmental engagement. According to Liu and Zhang (2024), digital tools not only amplify environmental knowledge but also stimulate more favorable predispositions toward sustainability. By integrating such technologies, the aim is not only to transmit knowledge but also to alter patterns, guiding learners toward more sustainable routines.

However, despite advances in the adoption of AIoT in education, current studies show a lack of research that methodically examines the effectiveness of such initiatives compared to conventional teaching methods. Such scrutiny is essential, as it allows us to discern and gauge which mechanisms are most effective in changing ecological attitudes. Previous research confirms that strategies linked to environmental literacy have a significant impact on the formation of pro-environmental attitudes (Ren et al., 2021; Rahman et al., 2023). However, the omission of analytical comparisons of the effectiveness of AIoT-based pedagogies versus orthodox ones remains widely documented (Patwary et al., 2024).

Similarly, Mustafa et al. (2021) note that environmental education is crucial for achieving tangible changes in students' environmental behavior, although they point out that the effectiveness of different teaching strategies still requires careful examination. It is therefore imperative to investigate how AIoT-based educational initiatives compare to more traditional practices, examining their potential advantages and disadvantages.

AIoT-based teaching initiatives have begun to attract attention within the field of pedagogy, particularly in the area of building ecological attitudes among university students. As higher education

institutions explore suitable ways to integrate technology into their curricula, the contrast between these new technological solutions and classic teaching models becomes decisive. Over the past five years, several important studies have contributed to the clarification of this evolving field.

One of the key studies is that conducted by Saadé et al. (2023), which explores the challenges and possibilities of AIoT in the university setting, highlighting how this technology could influence the shaping of the pedagogical space and, therefore, attitudes towards the ecosystem. This research establishes a conceptual and practical basis for how AIoT can be implemented at different institutional levels, which is essential for interpreting changes in environmental provisions.

In a different sphere, the work of Ma et al. (2023) focuses on the application of cutting-edge educational practices, including AIoT in teaching, with the aim of promoting pro-environmental attitudes. The findings show that AIoT-based dynamics can promote greater student involvement in sustainable behaviors when compared to traditional methodologies (He et al., 2022).

Another noteworthy study is that of Ren et al. (2021), who explore the impact of ecological literacy on university students, revealing that AIoT training can substantially intensify pro-environmental attitudes, compared to more orthodox teaching methods.

The study conducted by Hwang (2023) reviews technical-educational courses that integrate AIoT components, showing that participants in such courses develop superior digital skills and environmental awareness compared to those who pursue more traditional training.

Despite the growing interest in incorporating AIoT into teaching, the literature review reveals several notable gaps regarding its effectiveness in modulating ecological dispositions in university students. The first gap lies in the scarcity of research that systematically compares AIoT-based initiatives with traditional pedagogical models. Ochiagha et al. (2023) point out that there are still shortcomings in current assessments of the efficiency of environmental literacy strategies, which highlights the urgent need for more in-depth studies in this area. Without these comparisons, it is difficult to determine which mechanisms are most effective in promoting pro-environmental attitudes.

The second shortcoming refers to the lack of long-term evaluations that track the influence of such strategies over time. Aliskhanova et al. (2023) indicate that many environmental programs lack systematic monitoring of the progress of beneficiaries, which could provide crucial data on the permanence of such transformations.

The third major shortcoming lies in the limited analysis of how the application of AIoT fits into diverse sociocultural frameworks. Begum et al. (2022) emphasize that the understanding of the effect of environmental literacy may vary according to local worldviews and principles.

A fourth gap is linked to the limited incorporation of recognized pedagogical principles in the design of AIoT-based training plans. Vidrevich et al. (2020) argue that environmental education should be based on theoretical frameworks that stimulate deep learning, although most recent studies do not explicitly mention such references.

Finally, the fifth gap lies in the limited use of meta-analyses to bring together and compare findings from related research. Obasi and Osah (2022) warn that the omission of systematic reviews of previous data prevents a comprehensive understanding of patterns and behaviors in the effectiveness of training strategies.

This article aims to systematically evaluate and compare the effectiveness of AIoT-based educational interventions versus traditional teaching methods in modifying the environmental attitudes of university students, through the analysis of meta-analyses and case studies published in the last five years. This approach seeks to fill the thematic gaps identified above, offering a clear framework for understanding which teaching methods are most effective in promoting pro-environmental attitudes.

The findings reveal a diversity of approaches adopted to address the issue under investigation. Below is a detailed examination of the authors who propose answers to each of the questions raised in the study.

The findings highlight the importance of discerning the effects of AIoT-based educational interventions and contrasting them with traditional approaches to transforming environmental attitudes. The literature review reveals that, although multiple studies have addressed the impact of pedagogical strategies in general terms, few have incorporated the use of AIoT, which limits understanding in this specific field.

In Calixto-Flores' (2021) research, despite not using AIoT, the preeminence of symbolic representations in shaping pro-environmental attitudes within the educational environment is emphasized. The study argues that understanding teaching practices, rooted in sociocultural structures, is fundamental to attitudinal change, remaining relevant in the debate on the incorporation of emerging technologies in educational spaces. For their part, Corzo Márquez et al. (2022), although not integrating AIoT, affirm that the validation of knowledge is a determining factor in the formation of environmental attitudes, indicating that pedagogical principles must be analyzed through the prism of technological innovations with the potential to strengthen such knowledge.

Despite advances in emerging methodologies, as evidenced by the study by Cárdenas Jáuregui (2022)—through a comparison between experimental and control groups—the validity of traditional interventions to promote environmental attitudes is reaffirmed. However, the author points to the need for rigorous exploration of the relationship between the effectiveness of AIoT and environmental education programs. Comparisons between approaches such as gamification (Alcívar Rivadeneira et al., 2023) and conventional methods show notable variations in participation and motivation, although the direct influence of these methodologies on eco-awareness has not been systematized.

Additionally, Jiménez Zambrano et al. (2024) show how AI tools outperform traditional methods in educational assessments, opening up possibilities for their adaptation in environmental contexts. Although the focus is not on environmental education, an aspect of innovation is recognized that requires further study, highlighting the need for detailed analyses that incorporate the use of AI.

The limitations of this study lie in the scarcity of research that directly compares educational interventions with AIoT versus traditional methods in the environmental field. Numerous studies lack meaningful comparisons of their effect on ecological attitudes within the university environment. The lack of literature linking AIoT and pro-environmental attitudes makes it difficult to draw conclusive conclusions about its effectiveness compared to conventional methodologies. Likewise, cultural and socioeconomic variations in the contexts analyzed limit the generalization of the findings.

Future research should focus on the integration of AIoT technologies into educational interventions and their direct comparison with traditional pedagogical practices in environmental education. It is recommended that longitudinal studies be developed to examine sustained effects, as well as multicultural approaches that take contextual particularities into account. Similarly, it would be advisable to design validated assessment tools that accurately measure environmental attitudes in AIoT scenarios. Finally, it is suggested that the use of immersive and connected technologies be considered to enable an in-depth assessment of their impact on long-term commitment and attitudinal transformation.

Given the rapid development of emerging technologies, it is essential that environmental education be reformulated using innovative methodologies. The articulation between tools such as AIoT and proven pedagogical practices is imperative to increase the effectiveness of training programs, suggesting that this convergence could have a substantial impact on the consolidation of ecological awareness in future generations.

Conclusions

The research carried out shows that educational proposals based on AIoT have the capacity to transform the environmental attitudes of university students, although empirical evidence on their specific impact remains scarce. Among the most relevant findings, it is noteworthy that the adoption of innovative methodologies that incorporate AIoT strengthens students' understanding of and commitment to sustainable practices. Studies such as that by Cárdenas Jáuregui (2022) show significant improvements in environmental attitudes when applying pedagogical approaches with technological components, although these do not always explicitly include AIoT. These results are crucial, as they establish a link between emerging technologies and environmental education, suggesting that methodological adaptation can offer new ways to promote ecological awareness in university contexts.

In line with the stated objective of systematically examining and comparing the effectiveness of AIoT-based educational interventions versus traditional methods, this review has shown that, although such strategies can have a positive effect on changing pro-environmental attitudes, there is still a shortage of studies that explicitly integrate the AIoT dimension into their evaluation. Most of the research reviewed, such as that by Corzo Márquez et al. (2022), has validated the effectiveness of conventional environmental education but has not adequately explored the impact of advanced technological tools in university settings, limiting itself to more traditional perspectives. This reveals a priority area for future research, which should consider how to implement AIoT effectively to optimize results in environmental education.

This work is framed as a systematic review, which allows the conclusions obtained to be contextualized within a rigorous methodological structure. The strategy adopted has facilitated a comprehensive collection of evidence, highlighting the need to evaluate and compare different pedagogical approaches, which provides a solid basis for future research in the area.

As environmental challenges become increasingly complex, it is essential that education evolves to integrate effective pedagogical approaches that connect students with sustainability. This review has identified a considerable gap in academic production related to the use of AIoT in environmental education, suggesting that future research should focus on designing and evaluating interventions that effectively integrate these technologies. It is also essential that such studies consider both the effectiveness of the interventions and the cultural and socioeconomic particularities of the contexts in which they are applied, in order to increase their relevance and applicability in the formation of citizens committed to environmental responsibility.

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Analysis of nonverbal communication and communicative interaction in teachers and students during virtual teaching in a pandemic

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Introduction

In recent times, the communication process in the field of education has undergone substantial changes. The COVID-19 pandemic forced universities to adopt virtual teaching models, drastically replacing face-to-face interaction with an environment mediated by digital platforms. This radical change raised questions about how the essential components of human communication developed, particularly nonverbal communication and communicative interaction between teachers and students, which are essential elements for meaningful teaching.

From a psychological and communicational perspective, various authors have emphasized that nonverbal communication (NVC) is not only a complement to oral language, but also an autonomous system that conveys emotions, attitudes, and interpersonal dispositions. Rulicki and Cherny (2012) define it as the set of gestures, postures, looks, tones of voice, and non-verbal signals that constantly accompany communication. Valiente (n.d.) points out that human beings, even involuntarily, communicate through multiple channels, revealing the depth and complexity of the phenomenon of communication.

In this context, the question that guides this research is: How did nonverbal communication and communicative interaction between teachers and students develop in the context of virtual teaching due to COVID-19? Based on this, the object of study is to analyze the association between these two communicative aspects in virtual university education, recognizing that physical distancing may have affected traditional teaching-learning dynamics.

This chapter contributes to the science of educational communication by showing how forms of nonverbal communication were maintained or transformed in a digital environment characterized by technological mediation. Using a mixed methodology, perceptions of both teachers and students are collected, allowing for the construction of a comprehensive view of communicative interaction in times of crisis. The research concludes that, although teachers expressed interest and confidence through nonverbal cues, these did not always succeed in encouraging effective communicative interaction among students. Thus, it offers a significant contribution to rethinking pedagogical models in virtual environments, underscoring the need for communicative strategies adapted to the digital ecosystem.

Theoretical development of the research

Throughout human history, communication has undergone constant evolution, moving from verbal forms to complex systems of nonverbal expression. Initially, oral communication was the main channel for the transmission of ideas; however, over time, forms of communication that do not depend on spoken language emerged, such as gestures, postures, facial expressions, and tone of voice, which have essentially complemented the act of communication (Báez, 2000; Rulicki & Cherny, 2012). As Meharabian (1971) argues, 93% of a message's impact is determined by nonverbal components, with 55% corresponding to body language and 38% to tone of voice, leaving only 7% to the literal content of the message.

Nonverbal communication (NVC), from the perspective of communication psychology, has been the subject of extensive research, especially in educational contexts where it significantly influences understanding, emotional support, and trust-building between teachers and students (Patterson, 2019; Kendon, 1990). However, the forced transition to virtual environments during the coronavirus epidemic disrupted these interpersonal dynamics. Digital platforms such as Zoom and Google Meet, while allowing for educational continuity, limited nonverbal expressiveness due to the restricted use of cameras and microphones, making it difficult to read emotions and provide immediate feedback between educational actors (Smith, 2020).

In this regard, the question that guides this study arises: How did nonverbal communication and communicative interaction between teachers and students develop in the context of virtual teaching due to COVID-19? In response to this question, we begin with the assumption that nonverbal communication, despite its limitations in the virtual environment, was able to maintain certain levels of effectiveness through paralinguistic (such as intonation) and kinesic (such as gestures within the camera frame) resources, but without achieving a significant impact on overall communicative interaction.

From the theory of communicative argumentation, it is argued that verbal language does not act in isolation, but is supported by a set of nonverbal signs that contribute to the clarity, intention, and effectiveness of the message. Therefore, it is a priority to explore, from a scientific and contextualized approach, how these elements were adapted or limited in virtuality. Johnson (2021) emphasizes the urgency of preparing teachers in digital communication skills to mitigate the effects of reduced nonverbal communication.

This chapter contributes to the science of communication and education by integrating key literature from databases such as ScienceDirect and recent empirical evidence, consolidating a critical view of the effects of educational digitization on human interactions. It also reaffirms the importance of NVC as an irreplaceable tool in the comprehensive training of university students, even in technology-mediated contexts.

This study is classified as basic or fundamental, whose essential objective is the generation of new theoretical knowledge without claims of immediate applicability (Mertens, 2014). This perspective is indispensable for the consolidation of solid scientific bases around complex phenomena such as nonverbal communication (NVC) and its effect on virtual educational processes.

The study was conducted using a mixed methodological approach, with a sequential comparative and non-experimental design. Given that no variables were manipulated, a cross-sectional design was used, collecting data at a single point in time (Bernal, 2000; Hernández, Fernández & Baptista, 2014). The study began with a qualitative observation phase of 30 virtual sessions taught by university professors, using a structured observation form. Subsequently, quantitative instruments (surveys) were applied to 186 students in order to assess their perception of NVC and teacher-student communicative interaction in virtual environments.

The study universe consisted of a population of 110 teachers and 320 students from a Peruvian university. The sample was selected using a non-probabilistic, intentional sampling method based on

previously defined criteria. The final sample consisted of 30 teachers (both sexes, aged between 30 and 60) and 186 university students (aged between 18 and 23).

The variables were evaluated using specific instruments. For the nonverbal communication variable, class session recordings, observation sheets, and a survey were used. For the communicative interaction variable, a self-assessment questionnaire was used and supplemented with in-depth interviews with three randomly selected students, one from each Professional School included in the sample.

In order to ensure the value and reliability of the instruments, Cronbach's alpha coefficient was applied, which is widely used to estimate the internal consistency of Likert-type scales (Córdova, 2013). This procedure ensured that the instruments accurately measured the dimensions of interest.

The operational stage of data collection began with a formal request for institutional permissions, followed by the simple random selection of three Professional Schools. Collaborators were informed of the relevance of the research and their consent was obtained. The recorded sessions were then evaluated using the observation form. In the second phase, the questionnaires were administered in digital format, ensuring confidentiality and providing clear instructions for their correct completion.

The estimated duration of the questionnaires was 50 minutes. Interviews with students complemented the data obtained. Finally, the results were analyzed and categorized using descriptive statistics (absolute and relative frequencies) and inferential statistics, such as Pearson's correlation coefficient, which allowed relationships between the study variables to be established. The quantitative analysis was processed using SPSS v26.0 software, thus consolidating a comprehensive and comparative reading of the findings.

This chapter demonstrates the rigorous application of a coherent methodological process adapted to the nature of the object of study, contributing significantly to the scientific understanding of the impact of nonverbal communication on teacher-student interaction within the virtual teaching scenario, especially in an unprecedented context such as that generated by the coronavirus epidemic.

Comparison of communicative interaction in both sexes

In terms of interest in communicating with peers during the virtual stage, young male students predominate, while among women it reaches 93%. The chi-square test showed that there is a significant difference in terms of peers telling you about their problems, with a significance value of 0.041.

In terms of security in communication with peers during the virtual stage, young male students predominate, while among women it reaches 93%. The chi-square test showed that there is a significant difference in terms of peers telling you about their problems, with a significance value of 0.041.

In terms of shyness when interacting in the virtual environment, both genders participate equally, interrupting the conversation only when necessary, as mentioned by 89% of both groups. while in terms of intervention, they do so with a signal in the university's virtual classroom, which is more prevalent among female students at 61%. They mention that when they converse, they seek to be understood, which is prevalent in 73% of female students.

In terms of superiority, according to the students, it is noted that they want their ideas and expressiveness to be heard by their peers, mentioning that they are skilled at making gestures, as detailed by 86% respectively, while mentioning that it is difficult for others to understand their feelings through their expressions and interventions due to the virtual nature of the situation. Furthermore, the chi-square test showed that there is no difference between the two groups.

Comparative analysis

The ongoing research has provided an opportunity to assess the importance of nonverbal interaction in higher education, in the relationship between teachers and students in virtual classes. The results are presented below, comparing them with the existing literature and taking into account the internal and external validity of the study.

Internal validity relates to the methodology selected for the study and each of the steps that comprise it. The construction of a problem as complex as communicative mediation through NVC in virtual environments requires a comprehensive approach, and that is the path taken with a mixed sequential exploratory design. The first qualitative phase was based on systematic observation and recording of the components and actors of the virtual classes. In addition, a structured survey was conducted with students at different levels, and with the focus groups, the different positions were overcome. These were complemented and greater possibilities for strengthening the argument were obtained through the suggestive questions of Fetters Curry and Creswell (2013).

The sample size (30 teachers and 186 university students) was adequate to achieve statistical significance in the descriptive and inferential analyses. Although the selection was non-probabilistic and intentional, this choice was made with certain criteria of relevance and teaching experience, which improves the representativeness of the phenomenon under study.

The instruments used were approved by expert judgment, which guarantees content validity, and through pilot tests that ensure their operational validity. The internal consistency of the questionnaires was evaluated and confirmed by Cronbach's alpha reliability coefficient of the results above the threshold of 0.80 in all dimensions, indicating high consistency (Tavakol & Dennick, 2011). In addition, correlation and chi-square tests were used to measure relationships and differences between variables. These procedures reinforce the interpretive validity of the analysis.

Simultaneously, it was possible to verify the alignment of congruencies between observations of teaching practice and students' perceptions along with their responses in interviews by cross-analyzing and systematically analyzing the information collected through various techniques. This methodological process further enhanced internal validity by using multiple sources of evidence, which is a fundamental principle in mixed methods research (Creswell & Plano Clark, 2017).

In terms of limitations, it is recognized that the context of the pandemic affected the spontaneity of the virtual interactions observed and that low participation with cameras on limited the analysis of particular elements of nonverbal communication (NVC). That said, preliminary findings were achieved through what can be called methodological adaptation strategies, such as the classification of paralinguistic patterns and the systematic observation of gestures within the visible frame. Thus, it can be stated that, despite the limitations imposed, the findings are credible and scientifically relevant.

In terms of external validity, the results obtained in this study should not be automatically considered generalizable to all university educational contexts, as the research was conducted at a branch of a Peruvian university that has its own sociocultural characteristics. However, it is possible to affirm that the findings are transferable to similar contexts, especially those in developing countries that have experienced accelerated virtualization processes and share common problems of technological and pedagogical gaps (Rodriguez-Mena et al., 2022).

The methodological design, including the collection and analysis instruments, can be applied in different academic environments as long as contextual adaptation and technical revalidation are implemented. In this sense, the study contributes not only with relevant empirical findings but also offers a comprehensive methodological framework for conducting research on CNV in digital environments, thus improving its effectiveness as a reference for further research on communication skills in distance education environments.

The findings of the current research are partially aligned with the most recent studies on communicative challenges in virtual environments. For example, Johnson (2021) notes that educational interaction in virtual space is negatively affected by the lack of nonverbal cues, which supports our findings that, although instructors projected a sense of security and interest through some gestures and voice inflections, there was no noticeable increase in student participation or active engagement.

Similarly, Smith (2020) points out that the limited use of visual aids, such as full body language, eye contact, or shared space, reduces the effectiveness of the communication process. This statement is validated in our study, where the frame size decreased the level of kinesis as the webcam was cropped and many participants had their video turned off.

However, some studies offer nuances. Burgoon and Guerrero (2011) argue that paralinguistic elements such as intonation, voice modulation, and strategic pauses retain their power in virtual environments as long as they are pedagogically driven. This claim is partially supported by the qualitative data from this study, in which some students reported feeling motivated by the energy or enthusiasm projected by their teachers, although this did not significantly alter overall levels of interaction.

Furthermore, research conducted by Oyarvide, Diaz, and Alvarez (2021) emphasizes that teacher communicative competence goes beyond language use and includes managing emotions, motivating participation, and building trusting relationships, all of which require specialized training. This statement reinforces one of the most important conclusions of our research: the dominant gap in the digital communication skills of primary school teachers is alarming and needs immediate attention.

The absence of movements given to students by the teacher during a virtual class, according to the working hypothesis, improves, facilitates, or promotes communication in the class. However, a priori, this hypothesis was partially accepted. Although the result was favorable, the positive perception of movement was not positively correlated with an increase in "participation" and "effective interaction" with the class or group.

This fact requires new assumptions to be made about the constructivist strategy used in videoconferences. The anecdotal claim that has been verified cannot be based on verifiable facts. The explanation for why CNV does not generate interaction in virtual environments lies in the fact that it supports pedagogical design, institutional culture, and, above all, the teacher and their digital skills. Reality shows that a series of changes towards technological pedagogy with a didactic approach are essential. Based on this verification, we can formulate future research questions:

"Communication in virtual environments is more influenced by active pedagogies and the intentional application of technology than by nonverbal communication in the strictest sense."

This new line of research would allow us to examine the use of participatory strategies, gamification, emotional intelligence, and instructional design as adaptive modulators of educational interaction in technology-mediated contexts.

Conclusions

This research has shown that nonverbal communication (NVC), despite retaining its expressive capacity through paralinguistic resources in virtual environments, does not have a significant impact on communicative interaction among university students. Although teachers projected interest and confidence, these manifestations did not translate into greater student participation , which highlights the limitations inherent in the technological framework that mediates virtual classes.

It was identified that the dimensions of communicative interaction, such as interest, confidence, shyness, and perception of superiority, show significant differences according to the gender of the students, especially in the way they express their willingness to interact. However, non-verbal

communication by teachers was not a determining factor in modifying these dimensions, which calls into question its effectiveness in contexts of forced virtuality.

The lack of sustained eye contact, limited movement within the camera frame, and frequent visual disconnection due to students turning off their cameras hindered emotional reading and the establishment of a meaningful empathetic relationship, which are essential elements for the development of a humanized and bidirectional educational process.

The findings suggest that communicative interaction in digital environments depends more on pedagogical design, active methodological strategies, and the teacher's digital communication skills than on traditional components of nonverbal communication. In this sense, there is an urgent need to train teachers in specific virtual communication skills with a didactic and emotional focus.

Finally, it is recognized that digital educational models require a reconceptualization of classroom communication, integrating gamification strategies, emotional intelligence, and student-centered instructional design. These tools could compensate for the shortcomings of nonverbal language and foster virtual spaces that promote meaningful participation, motivation, and a sense of academic community.

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Entrepreneurial education in the professional school of psychology in the profile of university graduates at a public university

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Introduction

In the post-pandemic period, in which we find ourselves in an economic recession, job opportunities have decreased in companies. Faced with this scenario of global recession, it is important to be entrepreneurial, identifying niche markets and innovation as the key to differentiation.

Furthermore, this activity drives innovation in response to the problems facing society.

Having entrepreneurial skills allows one to identify opportunities in the environment that contribute to the longevity of business initiatives. (García-Castanedo et al., 2024) . In addition, the study explains the experiences of the results of entrepreneurship policies, which favor the entrepreneurial process (Birkholz, 2025)

Furthermore, entrepreneurial activity drives innovation, which in European countries has led to successful cases of economic activities adapting to digital transformation. . The study of the subject was deepened in the social sphere, at the corporate level, and in the search for market opportunities. (Shane & Venkataraman, 2000) .

In Peru, university underemployment reached 25.7% nationwide in 2020 and 25.4% on the coast. (SUNEDU, 2021) . The employed university population fell by 3.1% during the fourth quarter of 2022. (INEI, 2023) . This suggests that job opportunities have decreased and that other scenarios need to be considered.

The entrepreneurial process involves three stages to achieve success: the intention to seek independence, investing time and resources, and entrepreneurial behavior. (Martínez et al., 2023)

With the adaptation of university law, accredited professional schools included the subject of entrepreneurship in their curriculum to promote business creation from the university. The study focuses on the professional school of psychology during the 2017 curriculum. (UNSA, 2017)

In the following study, I seek to understand the experiences of university students from the professional school of psychology in business education and its contribution to their graduate profile during 2023.

Graduate profile

In addition to the technical skills of the profession, the graduate profile requires professionals to acquire soft skills that allow them to adapt to the labor market. Various studies recommend the synergy

of labor demand in companies with public and private institutions to provide market-oriented education. (Soria-Cuellar et al., 2025) .

Given the discontinuity of the demands of public and private companies, studies mention that a strategic learning plan is key to an ideal profile. (Baban, 2025) .

Entrepreneurial education

In university education prior to developing entrepreneurial skills, various profiles are identified, such as: the informal entrepreneur, out of necessity, who provides support in teaching and practicing innovation. (Quintano-Méndez et al., 2024) .

In addition, in the acquisition of entrepreneurial skills in the subject, sustainable entrepreneurship and experiential learning as a teaching method should be encouraged. (Vargas-Merino et al., 2025) . And in entrepreneurial intent, the driving motive is crucial, such as lack of income or business opportunities that in European Union countries allow for an improvement in quality of life and employment status(Vasilescu et al., 2025) .

In addition, Yanti et al. (2024) suggest that the development of courses and workshops on entrepreneurship and business management can apply the method of learning through experience, i.e., students can take on real cases and, if possible, be part of organizations where they can experience the real-life operation of a start-up or company. This will allow them to improve their entrepreneurial skills and propose improvements in the market through their active participation.

There are various experiences that are encouraged in the educational institution, including training programs that contribute to entrepreneurial culture and take advantage of financing opportunities and networking. (Casas et al., n.d.)

On the other hand, there are different tools that can be implemented, such as entrepreneurial education courses, consulting centers, and entrepreneurship platforms that can strengthen entrepreneurial skills, innovative talents, and achieve entrepreneurial success for students (Yin et al., 2020) .

The study is basic or fundamental in nature, with the essential objective of generating new theoretical knowledge.

The study described here approaches the subject from the paradigm of interpretivism and according to the vision of social constructionism. According to this worldview, it focuses on interpreting the opinions of subjects and understanding the world according to their experience. (Creswell, 2007) . And according to the qualitative approach, the study focuses on deepening the understanding of reality and its manifestations.

The method is phenomenological, as detailed in (Martínez M., 2004) , in that participants interpret reality according to their experiences and perceive the phenomenon according to the individual's consciousness. The reality interpreted was during the period of 2023.

The participants in the research are undergraduate students from the professional school of psychology who completed the entrepreneurship workshop course and two university classes (referred to as "social participants"). Using convenience sampling based on the characteristics mentioned in (Mejía, 2000) , students who voluntarily agreed to participate were selected.

The students who participated, referred to as "social participants," were assigned a sequential number, which was disclosed to them before the interview in order to protect the information provided. Fifteen students from both sections agreed to be interviewed, of both sexes and between the ages of 21 and 25.

The interview was used to collect information from the students. The technique was developed based on the research questions and topics in the categories of entrepreneurial education and entrepreneurial intention. The interview guide was designed by the research team with a mentor teacher from the incubator and a former entrepreneurial executive from the incubator at the public university in Arequipa.

The interview design was based on the categorization matrix and the research question. The core category of entrepreneurial intention was based on the model that details the elements of desirability, perceived feasibility, and propensity to act.

Table 1 Categorization matrix of the graduate profile

Category	Subcategory	Interview questions
Graduate profile	Traits and attitudes	Does the topic of entrepreneurship help graduates?
	Knowledge and skills	How do the subjects contribute to your knowledge in the field of psychology?

Note: Peña et al. (2016)

Table 2 *Graduates' profile categorization matrix*

Category	Subcategory	Interview questions
Business education	Teaching process	What was your experience of understanding the creative process for generating ideas and solving problems? How was the teaching of the entrepreneurship course?
	Teaching strategies and methodologies	In your opinion, what were the main difficulties in using the methodologies? Any others?
	Business skills	How did you feel about putting leadership into practice? In your opinion, what were the main difficulties in exercising leadership in your profession or other field? What social skills did the entrepreneurship course help you develop?

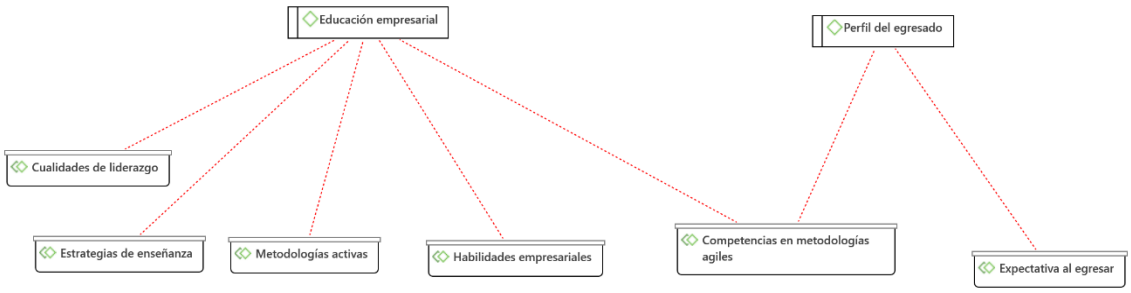
Upon completion of the process of results and generation of emerging categories, a semantic network was developed that reflected the emerging themes, categories, and codes. The systematization

process was carried out using the Atlas ti 24 qualitative analysis program through semantic networks and codes and categories.

The results were interpreted according to data triangulation covering primary and secondary sources and compiled interviews.

Based on the categories evaluated, four emerging themes were identified that interpret business education and the profile of psychology graduates. The theme of business education includes leadership qualities, business skills, and competencies in agile methodologies. The theme of graduate profile highlighted expectations upon graduation.

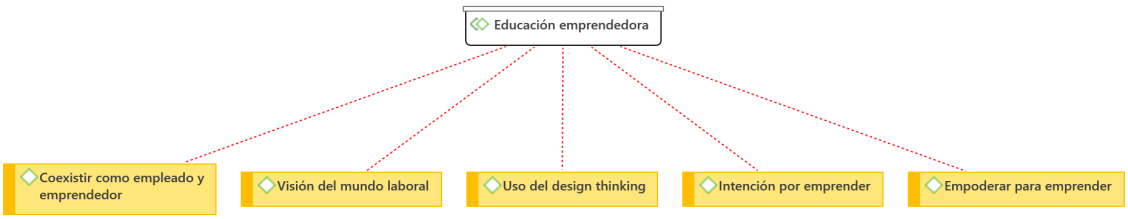
Figure 1 *Emerging themes in business education and graduate profiles*



Regarding the category of expectations upon graduation, students mentioned that entrepreneurship is a medium-term path in which, after completing the employee stage, they would seek to become independent and provide a service. The first is reflected in the interview collected when mentioning, "Well, it helps a lot because I am also thinking about finishing and being on par with an entrepreneurship so that it helps me a lot to support myself financially, so I don't depend 100% on my studies, but also start a business and thus help myself financially" (E4, par.10). The second opinion is reflected in the argument that "I believe that entrepreneurship as such contributes so much to empowering the individual" (E5, par.13). The results are consistent with the study (Alsaad et al., 2023) , which found that quality education is a determining factor for empowerment. This finding is reflected in the course, which sought to develop skills and attitudes to generate initiatives in psychology students.

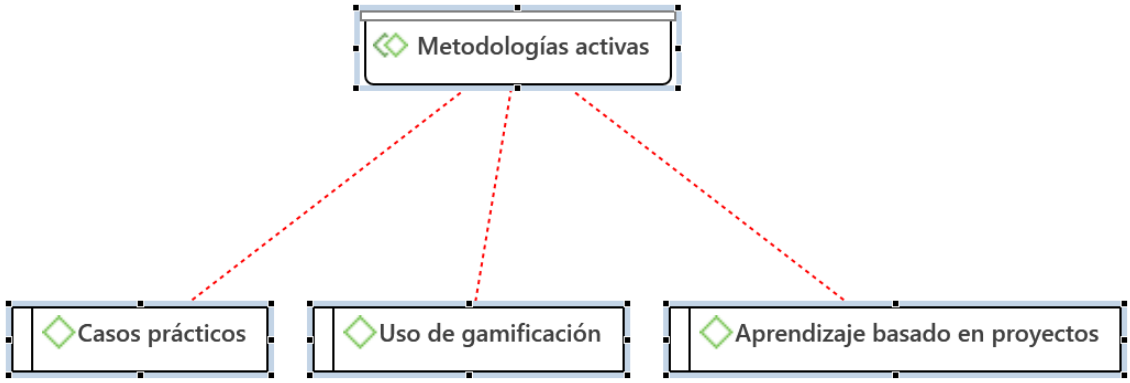
In the area of business education, the course taught leadership qualities: communication and collaboration for teamwork, a vision of the working world, and creative spirit. The students explained that the vision they gained at the end of the course allows them to analyze various aspects of their field of work, as explained in the opinion: "It helps a lot because you not only come away with theoretical or practical knowledge related to your profession, but you also come away with a vision of what the world of work or the labor market is like and how to start a business" (E15, par.18). Communication is key to teamwork when assuming the role of entrepreneur in the course, as interpreted by the student: "Firstly, communication is essential because if something goes wrong in communication, the team does not work, everyone splits up and does their own thing" (E1, par.7). In a review of studies by (Yue et al., 2019) on the elements that generate transformational leadership, communication is fundamental in the team, which is consistent with the results of the research. To drive personal change, (Robinson & Riddell, 2022) agrees that collaboration is key to leadership.

Figure 2 *Characteristics of business education*



Meanwhile, the agile methodology skills covered during the course included: empathizing with the customer, tools for entrepreneurship, and brainstorming techniques that contributed to the development of innovative products and services. As the student points out, understanding the problems faced by patients in their daily lives "To learn a little more about the perspective of what may be our future customers, to see what they want to know, their difficulties, their customer profile and so on" (E6, par.14). It is also detailed that the problem was addressed through brainstorming and looking at possible solutions, as explained by the student: "because we were going to make a business plan and to generate ideas, we got together in a group and brainstormed, each of us had a different perspective" (E2, par.1).

Figure 3 *Active teaching methodologies*

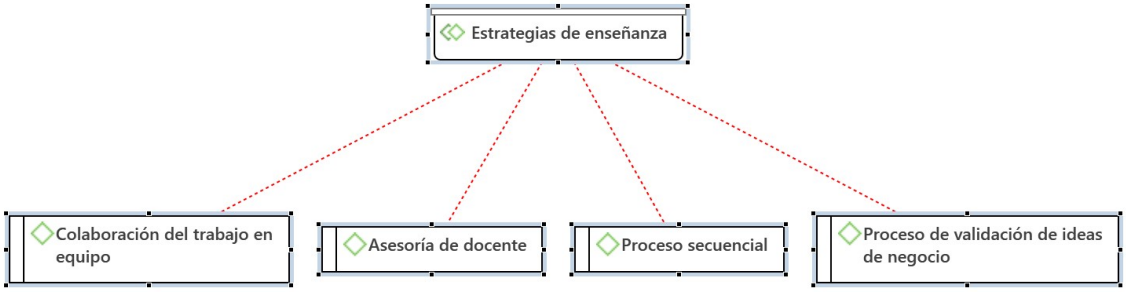


Three categories were found that the teacher used for experiential learning: project-based learning, practical cases, and the use of gamification.

In the project-based learning methodology, students evaluated viable ideas and creative solutions based on the problem addressed, as detailed by the students: "For me, it was a challenge, and it also allowed me to put all my ideas on the table, which I hadn't done before, so it was quite an enjoyable process for me because, as I said, it allowed me to experiment, get to know my classmates, learn about their ideas, structure them, and structure my own, but above all, specify which of all our ideas was really possible and could be carried out, not just for the course" (Interview 13, par. 1).

In the case study method, the teacher motivated the student with successful cases of entrepreneurs, as the student explains: "But as the course progressed, it was very interesting to see these new perspectives, the various cases that the teacher showed us of how people could undertake striking ideas with persistence and perseverance" (Interview 3, par. 1).

Figure 4 *Teaching strategies*



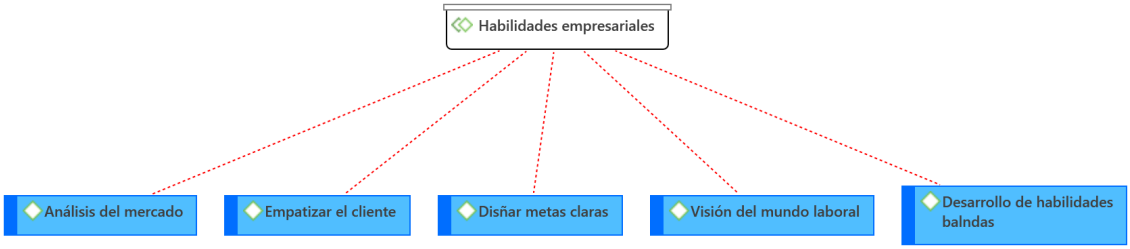
Four categories were generated in the main strategies instilled in the student: business idea validation process, teamwork collaboration, teacher guidance, and sequential process.

The business idea validation process was a sequential process in which the team led the evaluation of the idea's viability, as mentioned by the student: "In fact, I consider it a challenging experience because we first had to reach a consensus to agree on a creative idea and then develop it and see if that idea was viable in the long term and if, in this case, it was appropriate for our objective." (Interview 5, par. 1)

The teamwork that was promoted with the venture allowed us to validate business ideas and generate prototypes, as the students mention:

"Knowing how to listen to the team was essential to obtaining good results because if we didn't set our own deadlines for completing tasks and activities, we wouldn't get a grade and then we wouldn't understand either" (Interview 3, par. 4). "But when the teacher proposed the methodology for devising these business plans and we got together as a group, it meant that this could be carried out. There is always someone who contributes good ideas, takes them and directs them, not at first" (Interview 14, par. 6).

Figure 5 *Network of entrepreneurial skills*



During the course, with practical experience in developing their venture, it was identified that the students managed to acquire empathy. Empathy allowed them to understand the problems of their potential customers, as one student mentioned: "To learn a little more about the perspective of what may be our future customers, to see what they want to know, their difficulties, their customer profile, and so on" (Interview 6, par. 12).

In addition, it allowed them to gain insight into the world of work, where they acquired a perspective on working independently and as an employee in their field.

"It helps a lot because you not only come out with theoretical or practical knowledge related to your profession, but you also come out with a vision of what the world of work or the labor market is like, how to start a business" (Interview 15, par.15).

It also allowed them to develop soft skills, among which the main ones identified were leadership in taking on challenges when faced with problems and communication techniques for working with the team. These skills are in line with the principles of agile companies that seek creative solutions and

collective work (Álvarez, et al., 2019) .The information that was interpreted was based on the students' responses:

"The subject of Leadership helps psychology graduates to develop entrepreneurial skills, leadership adaptability, and also human talent" (Interview 9, par.16).

"It contributes to the profile in a comprehensive way, talking about hard skills and soft skills, which I was referring to as communication techniques, techniques for sharing information more effectively, and all that" (Interview 10, par. 16).

Figure 6 *Category of competencies in agile methodologies*



The agile competencies acquired allowed them to understand the phases of the design thinking methodology, which allows them to evaluate everything from the conception of the business idea to the possible solution. They were then given tools to undertake medium-term projects and, according to the students: "As I have been reiterating, it is essential to know how to enter the labor market, how to market ourselves, and how to navigate the business world because not everything is scientific research and books, so to speak." (Interview 11, para. 16), "we have the knowledge and tools to be able to create a business venture individually or in a group" (Interview 2, para. 16).

Brainstorming about problems in their career and/or entrepreneurship, where teamwork opinions strengthen new solutions, as the student explained: "Because we were going to make a business plan and to generate ideas, we got together as a group and brainstormed, and everyone had a different perspective" (Interview 2, para. 1).

The main results of this research are detailed under each of the objectives that were addressed:

Interpret the meanings of entrepreneurial education in the professional school of psychology in the profile of university graduates at a public university in Peru in 2023.

The results related to this general objective revealed that entrepreneurial education provided tools for entrepreneurship and soft skills management to strengthen entrepreneurial competencies. It also generated a change in perspective when attempting to start a business after graduation and helped to complement the innovation and entrepreneurship tools in the psychology degree program. This finding is also supported by Abdulkarim and Allen(2024) , who mention that the more business skills university graduates have, the greater their chances of managing their ventures properly and coping with economic crises. On the other hand, Suengkamolpisut and Chuensodsai(2025) refer to the importance of continuous evaluation of curriculum development, which must be aligned with Sustainable Development Goal 4, which is to improve the quality of education, and Sustainable Development Goal 8, which is to prepare students with the skills for economic growth.

Understanding the experience of entrepreneurial education in the professional school of psychology:

The results related to the specific objective revealed that, in terms of the meaning of business education, the subject has empowered students, allowing them to analyze the duality of employee and entrepreneur and to manage agile methodologies for entrepreneurship. The finding is also

supported by Sá et al.(2025) , who indicate that participating in educational programs on entrepreneurship increases the likelihood of creating and autonomously managing one's own business.

The results related to the specific objective of understanding the contribution to the graduate profile revealed that, in terms of the graduate profile, students consolidated their entrepreneurial skills at the soft and organizational levels. This finding is also supported by Quintano et al. (2025) , who indicate that academic training, educational practices, teacher training, graduate profile design related to business education, and partnerships with the community can influence youth entrepreneurship.

Conclusions

In the interpretation and perception of the information gathered on the subject of university education, four emerging categories were identified. The graduate profile includes the category of expectations upon graduation, while in business education, students are trained in business skills, leadership skills, and competencies in agile methodologies that provide them with tools for intrapreneurship and entrepreneurship in the medium term.

In the graduate profile, students have expectations to face the job market with the empowerment to undertake intrapreneurship with patients and form their own business in the medium term.

In the emerging topics of business education, leadership and collaborative work were taught in the course, providing tools for entrepreneurship and managing soft skills to strengthen entrepreneurial competencies; a change of perspective when attempting to start a business upon graduation; complementing the tools of innovation and entrepreneurship in the psychology career.

In terms of the meaning of business education, the subject has empowered students to analyze the duality of employee and entrepreneur and to manage agile methodologies.

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Real-Time PCR vs. Conventional Methods for Detecting E. coli and A. brasiliensis in Pharmaceuticals

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Introduction

Pharmaceutical industries routinely conduct laboratory tests to ensure product quality in terms of purity, safety, and efficacy (FDA, 21 CFR Parts 210 and 211, Current Good Manufacturing Practice Regulations). For regulatory compliance, most microbiological analyses continue to rely on traditional culture-based methods established by pharmacopeia such as the United States Pharmacopeia (USP <62>, USP-NF 37, 2020). The USP sets minimum quality standards for pharmaceutical products; failure to comply with these monographs results in a product being classified as "adulterated" or "misbranded" under the Federal Food, Drug, and Cosmetic Act, prompting enforcement actions by the Food and Drug Administration (FDA). Among the established tests, the Test for Specified Microorganisms (TSM) plays a critical role in ensuring that objectionable organisms are absent from both raw materials and finished products. These organisms, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Salmonella* spp., and *Candida albicans*, pose significant risks to consumer health and must be completely excluded from pharmaceutical preparations (USP <62>, USP-NF 37, 2020; Jiménez, 2007). Although the TSM remains a standard microbiological practice, it is often time-consuming and labor-intensive, involving prolonged incubation, phenotypic colony observation, and biochemical testing. These characteristics delay product release and limit the ability of manufacturers to respond rapidly to potential contamination (Ragheb et al., 2012; Kumar et al., 2021). Recent developments in molecular microbiology offer promising alternatives. For example, Ragheb et al. (2012) validated a polymerase chain reaction (PCR) technique capable of detecting key bacterial indicators such as *E. coli*, *S. aureus*, *Salmonella* spp., and *P. aeruginosa* in various pharmaceutical forms. Their method allows amplification of conserved bacterial genes in single or multiplex reactions and has shown high sensitivity and specificity for microbial detection. More recent studies have refined these approaches, integrating multiplex real-time PCR assays that simultaneously detect multiple pathogens with improved speed and accuracy (Lee et al., 2020; Zhao et al., 2023). Conventional methods, despite their historical relevance, generate considerable biological waste and require highly trained personnel for microbial identification. In contrast, real-time PCR has emerged as a rapid and highly sensitive technique for detecting objectionable organisms in pharmaceutical environments. It offers significant advantages, including reduced biological waste, faster turnaround times, and precise quantification of DNA at nanogram levels (Singh & Gupta, 2022). Furthermore, real-time PCR can detect microbial DNA even when organisms are in a viable but non-culturable state an important limitation of culture-based methods that depend on colony formation for detection (Oliver, 2010).

Successful implementation of molecular methods such as real-time PCR enables quality control microbiology laboratories to obtain deeper insight into product and process microbiology, thus helping meet increasingly rigorous regulatory and safety objectives (Smith et al., 2021). In line with USP chapters <61> and <62>, which establish microbiological testing requirements for non-sterile pharmaceutical products, this study focused on the detection of *Escherichia coli* ATCC® 8739™ and *Aspergillus brasiliensis* ATCC® 16404™ two objectionable organisms frequently monitored in pharmaceutical testing (USP-NF 37, 2020; Chen et al., 2022). The real-time PCR methodology was employed to evaluate its performance compared to traditional pour-plate methods for detecting and

identifying objectionable microorganisms in over-the-counter (OTC) pharmaceutical products. Emphasis was placed on three dosage forms: solids, liquids, and creams representing common pharmaceutical preparations. Experimental testing was conducted strictly according to USP criteria, with a focus on sensitivity, precision, reproducibility, time-efficiency, and cost-effectiveness.

This study highlights that real-time PCR can deliver accurate detection results within 30 minutes, a significant improvement over conventional methods that typically require 24–48 hours for bacteria and 5–7 days for fungi. The ability to rapidly detect objectionable organisms in raw materials, excipients, environmental samples, and finished products supports a more agile and responsive quality control process. Real-time PCR also demonstrated comparable accuracy in quantifying microbial load across different stages of microbial growth, with results closely mirroring colony-forming unit (CFU) counts, except during specific physiological states such as starvation in certain anaerobes. Overall, this investigation presents real-time PCR as a robust, sensitive, and cost-effective molecular alternative to conventional TSM methods for pharmaceutical microbiological quality control. Its adoption could lead to faster product release, improved contamination monitoring, and enhanced public health protection by ensuring pharmaceutical products are free from harmful microorganisms (Kumar et al., 2021; Zhao et al., 2023).

Scientific and Regulatory Framework of Pharmaceutical Microbiology

Microbial Contamination in Non-Sterile Pharmaceutical Products

Microbial contamination remains a persistent and serious issue in pharmaceutical manufacturing, particularly in tropical climates and developing countries. Such contamination is a leading cause of product recalls worldwide, highlighting deficiencies in preservative systems, manufacturing controls, and packaging integrity (Jiménez, 2007). Non-sterile pharmaceutical products are susceptible to microbial intrusion at every stage from raw material acquisition to storage and distribution (Jiménez, 2001). Microorganisms such as *Burkholderia cepacia*, *Pseudomonas* spp., and *Ralstonia pickettii* have been recurrently linked to water systems, while fungi and Gram-positive cocci often signal poor environmental control (FDA, 2014; Kumar et al., 2021; Singh & Gupta, 2022). Contamination can compromise product quality, degrade active ingredients, and pose health risks, particularly for immunocompromised individuals, infants, and the elderly. Even non-viable microbial cells can elicit harmful reactions, underscoring the importance of effective detection and control strategies. The pharmaceutical industry must therefore implement robust microbiological quality systems supported by both regulatory guidance and scientific innovation (Smith et al., 2021).

Compendial Methods: USP <61> and <62>

The United States Pharmacopeia (USP) establishes microbiological standards for non-sterile pharmaceutical products, primarily through chapters <61> (Microbial Enumeration Tests) and <62> (Tests for Specified Microorganisms). These methodologies include plate count techniques, membrane filtration, and selective media use for detecting objectionable organisms such as *Escherichia coli*, *Salmonella* spp., *Staphylococcus aureus*, *Candida albicans*, and *Pseudomonas aeruginosa* (USP-NF 37, 2020; Jiménez, 2007). Although considered gold standard and widely accepted by regulatory authorities, compendial methods are inherently slow often requiring 5 to 7 days for results and prone to limitations in sensitivity, particularly when detecting low microbial loads or injured/non-culturable cells. Moreover, the qualitative nature of microbial recovery may result in ambiguous outcomes without confirmatory testing (Zhao et al., 2023).

Advances in Rapid Microbiological Methods (RMMs)

To overcome these limitations, the pharmaceutical industry is progressively adopting Rapid Microbiological Methods (RMMs). These techniques include ATP bioluminescence, flow cytometry, MALDI-TOF, and molecular diagnostics such as polymerase chain reaction (PCR) and quantitative real-time PCR (qPCR). These tools offer superior sensitivity, specificity, and turnaround time, allowing microbial detection within hours rather than days (Kumar et al., 2021; Juárez, 2016). Real-time PCR, in particular, has demonstrated exceptional utility in detecting and quantifying microbial DNA from both viable and non-viable cells. Studies have shown that qPCR can detect organisms at concentrations as low as 1 CFU/mL or gram, with results available within 30–50 minutes depending on the protocol (Skof et al., 2007; Samadi et al., 2007; Lee et al., 2020; Kawasaki et al., 2010). Multiplex PCR systems enable simultaneous identification of multiple objectionable organisms, reducing the time and cost associated with sequential testing. Assays targeting 16S rRNA, ITS regions, or specific virulence genes have been developed for a broad range of pharmaceutical-relevant organisms, including *E. coli*, *S. aureus*, *A. brasiliensis*, and *Salmonella* spp. (Karanam et al., 2008; Schabereiter-Gurtner et al., 2007; Zhao et al., 2023).

Comparison Between Traditional and Molecular Approaches

Although molecular methods require higher initial investment and skilled personnel, their benefits in terms of speed, precision, and data reliability make them increasingly attractive for routine pharmaceutical quality control (Bustin, 2009; Ragheb et al., 2014; Smith et al., 2021). Validation is essential to ensure equivalency with compendial tests and to satisfy regulatory requirements.

Regulatory Framework and Industry Guidance

Current Good Manufacturing Practice (cGMP) regulations in 21 CFR Part 211 mandate microbial testing at various production stages. Specifically, Sections 211.84(d)(6), 211.113(a), and 211.165(b) require testing of raw materials and finished products for objectionable organisms based on intended use (FDA, 2014). Recent FDA guidance promotes science- and risk-based microbial control strategies (FDA, 2023). USP <1111> addresses microbiological quality of non-sterile products, considering route of administration, preservatives, and target populations (USP-NF 37, 2020), and highlights the role of expert microbiological judgment. International bodies such as ICH, EMA, and WHO advocate harmonized, risk-based approaches and emphasize the shift toward validated, proactive testing (ICH Q9(R1), 2023; EMA, 2022; WHO, 2021).

Real-time PCR Applications in the Pharmaceutical Context

Although widely used in clinical diagnostics and food safety, Real-time PCR remains underutilized in pharmaceutical microbiology. Studies by Jiménez et al. (2001) and Lee et al. (2020) highlight its superior speed and sensitivity over culture-based methods for detecting *E. coli*, *A. brasiliensis*, *S. aureus*, and other pathogens in pharmaceutical matrices. It has also proven effective for detecting microbial contamination in raw materials (e.g., gelatin, excipients) and final dosage forms like ointments and syrups, reducing the risk of large-scale recalls (Kumar et al., 2021; Zhao et al., 2023). Advancements in probe specificity, thermal cycling, and high-throughput capability have minimized false positives. Platforms such as StepOne™ Plus, LightCycler®, and ABI Prism are increasingly adopted in pharmaceutical labs (Changsoo et al., 2005; Singh & Gupta, 2022).

Challenges and Implementation Considerations

Implementing Real-time PCR in pharmaceutical microbiology involves technical, economic, and regulatory considerations. Establishing a PCR-capable laboratory requires investment in instruments,

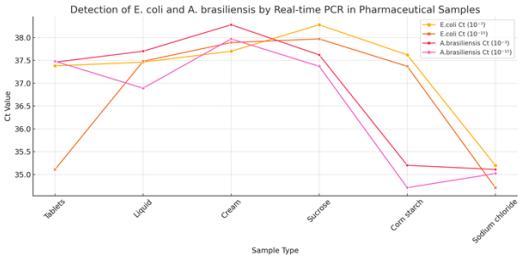
validation protocols, trained personnel, and robust quality systems. False positives due to DNA from dead cells or environmental contamination must be mitigated through proper controls and interpretation criteria (Ragheb et al., 2014; Oliver, 2010). Nonetheless, the long-term cost-effectiveness and performance benefits of Real-time PCR are well documented. By reducing product release times, decreasing labor and media usage, and enhancing data traceability, molecular tools support streamlined quality assurance workflows. Moreover, reduced test variability improves confidence in final product integrity and regulatory compliance (Smith et al., 2021).

Justification for the Present Study

Given the limited but growing body of literature addressing the use of Real-time PCR for microbiological testing in the pharmaceutical industry, this study addresses a critical gap. It focuses on evaluating the application of Real-time PCR for the detection of *Escherichia coli* ATCC® 8739™ and *Aspergillus brasiliensis* ATCC® 16404™ in over-the-counter pharmaceutical products. The goal is to provide a validated, efficient, and cost-effective alternative to conventional methods one that aligns with global trends toward faster, more accurate, and high-throughput microbial monitoring systems (Zhao et al., 2023; Singh & Gupta, 2022).

The Real-time PCR method demonstrated superior performance compared to conventional microbiological techniques in detecting *Escherichia coli* ATCC® 8739™ and *Aspergillus brasiliensis* ATCC® 16404™ in both raw materials and over-the-counter (OTC) pharmaceutical products (see Table 1). The molecular method enabled detection of *E. coli* in artificially inoculated samples within approximately two hours, whereas the conventional method required 24–48 hours for colony development and subsequent biochemical confirmation. For *Aspergillus brasiliensis*, detection by Real-time PCR was achieved within three hours, while traditional culturing methods required 5–7 days for conclusive identification. This significant reduction in detection time not only demonstrates the efficiency of the molecular approach but also suggests its potential to enhance real-time decision-making in pharmaceutical quality control. Furthermore, the Real-time PCR method showed high sensitivity and reproducibility, with less than 5% variation among triplicate samples, confirming its reliability. Importantly, this method proved effective in complex sample matrices such as syrups and powdered formulations, indicating its robustness under realistic testing conditions (see Figure 1). These findings are consistent with previous research that highlights the utility of molecular methods for rapid microbial detection in the pharmaceutical field, and they support the integration of PCR-based protocols into standard microbial quality testing workflows. While the benefits are clear, it is worth noting that potential limitations include the need to monitor for PCR inhibitors in complex formulations, which could affect amplification efficiency. As such, the inclusion of internal amplification controls is recommended for routine implementation. Future studies may explore the validation of this method for a broader spectrum of objectionable microorganisms and product types. Ultimately, the adoption of Real-time PCR could significantly improve the speed, reliability, and regulatory compliance of microbiological quality control programs within the pharmaceutical industry.

Figure 1. Amplification curves of *E. coli* and *A. brasiliensis* across pharmaceutical matrices using TaqMan® Real-time PCR assay, showing detection at multiple dilution levels, including 10^{-1}–^{5}.



Integration of Experimental Phases and Expanded Sensitivity Analysis

This study was conducted in two distinct experimental phases to evaluate the sensitivity, specificity, and comparative performance of the conventional pour-plate method and the molecular Real-time PCR approach for detecting objectionable microorganisms in pharmaceutical products and raw materials. In Phase I, a sensitivity assay was performed using serial dilutions of *Escherichia coli* ATCC® 8739™ and *Aspergillus brasiliensis* ATCC® 16404™ to determine the minimum detectable concentration of viable cells using both methods. For *E. coli*, the conventional method was able to detect bacterial growth up to a dilution of 10^{-9}, beyond which no colony formation was observed. In contrast, Real-time PCR successfully detected the target DNA in all tested dilutions from 10^{-1} to 10^{-15}, demonstrating a significantly higher level of sensitivity. This performance was consistent across triplicate runs, with amplification curves surpassing the threshold cycle (Ct) even at the most extreme dilutions (Ct ≈ 33.39 at 10^{-15}). Similarly, the conventional method detected *A. brasiliensis* colonies only up to a dilution of 10^{-5}, while Real-time PCR detected fungal DNA in all serial dilutions, including 10^{-15}. This provides strong evidence of the superior detection capability of Real-time PCR when compared to traditional microbiological techniques. A notable aspect of this investigation was the evaluation of cell viability using Cellometer® Auto M10. Results showed a gradual decline in live cells across dilutions, with complete absence of viable cells from 10^{-13} to 10^{-15}. Despite the absence of viable cells at these high dilutions, Real-time PCR continued to detect DNA, underscoring its ability to identify both live and dead cells. However, the focus of this study emphasized the importance of detecting viable microorganisms, particularly for pharmaceutical safety. Dilutions with confirmed live cells 10^{-7} for *E. coli* and 10^{-3} for *A. brasiliensis* were used to contaminate raw materials and finished products for Phase II (Test for Specified Microorganisms, TSM). In Phase II, these contaminated samples were analyzed using both detection methods. The conventional method consistently failed to detect microorganisms at the 10^{-15} concentration, while Real-time PCR detected both bacterial and fungal DNA across all matrices tested, including tablets, liquids, creams, and raw ingredients such as sucrose, corn starch, and sodium chloride. These findings highlight the robustness and reproducibility of Real-time PCR as a highly sensitive method, capable of detecting trace-level contamination that remains undetectable using standard USP <61> and <62> techniques. The amplification of DNA using organism-specific primers (targeting 16S rRNA for *E. coli* and the ITS region for *A. brasiliensis*) demonstrated reliable detection even in the presence of potentially inhibitory sample matrices. The evidence confirms that Real-time PCR provides a practical, rapid, and highly sensitive alternative to conventional methods for microbial detection in pharmaceutical quality control. The Real-time PCR method demonstrated the ability to detect both *E. coli* and *A. brasiliensis* at dilutions as low as 10^{-15} in all sample types, including pharmaceutical finished products and raw materials, while the conventional method failed to detect any growth at these levels.

The Real-time PCR method using TaqMan® probes, specific primers, and a simplified sample preparation protocol demonstrated significantly greater sensitivity, accuracy, and reproducibility compared to the conventional pour-plate method for detecting bacterial and fungal contamination at levels below 1 CFU in both raw materials and pharmaceutical products. Specifically, Real-time PCR reliably detected *E. coli* ATCC® 8739™ at dilutions as low as 10^{-3} and 10^{-15}, and *A. brasiliensis* ATCC® 16404™, across all analyzed matrices. The method showed high specificity even at ultra-trace concentrations (10^{-15}), outperforming conventional methods, and proving to be a rapid, accurate, and effective tool for the sensitive detection of objectionable microorganisms as required by USP Chapter <62> and for microbial enumeration under USP Chapter <61>. Pharmaceutical manufacturers are encouraged to incorporate Real-time PCR methodologies into their standard operating procedures (SOPs), validation protocols, and quality control systems. This molecular approach can enhance microbial monitoring and ensure compliance with pharmacopeial requirements for non-sterile products. This study provides a foundational contribution by outlining a step-by-step protocol for the

implementation of Real-time PCR in microbiological testing of raw materials and OTC pharmaceutical products. Adopting this methodology may significantly reduce detection time, improve sensitivity, and offer reliable alternatives to traditional culture-based techniques. As molecular diagnostic platforms advance, the future implementation of automated, ultra-sensitive Real-time PCR systems may redefine the standards of pharmaceutical microbiological quality control. Moreover, the remarkable sensitivity of the Real-time PCR method, capable of detecting target microorganisms even at dilution levels of 10^{-15}, underscores its potential as a valuable tool for stringent quality control. However, its implementation in industrial settings requires careful validation protocols to balance detection limits with practical thresholds of microbiological risk.

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Benefits and challenges of open innovation in Mexico: a mixed study

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Introduction

Open innovation (OI) is the type of innovation where companies use external and internal ideas to generate new products and services. It is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation (Chesbrough, 2006). The more a company interacts with others, it has more opportunities to acquire ideas, abilities, knowledge and technology, increasing therefore its probabilities of success (Portocarrero García, 2023).

The use of an open approach, which involves sharing and gathering external knowledge, may vary depending on each company's approach, its value proposition, or its industry. Information spillovers are a known risk factor in OI, as is the need to control the company's intellectual property. However, its benefits, such as cost reduction, the development of new processes, and the creation of a support network, among others, are also attractive. In addition, the level of collaboration between companies and intellectual property agreements determines the co-branding strategy they will follow when launching a new product or service.

Although much has been written about OI, it is a relatively new concept that companies still struggle to apply, depending on the focus the company has, and other factors. Portocarrero García (2023) does a literature review and finds that there is still opportunity for more research based on experiences from different sectors, type of companies and regions. The present study tries to generate knowledge on OI based on medium and large sized enterprises, from a variety of sectors.

Barrios et al. (2022) find that Italy, the UK, Germany, Spain and the USA is where more studies on OI have taken place. Hence, there is an opportunity to bring insights from other countries. This study is conducted in Mexico, the second largest economy in the Latin American region.

The objectives of this research are as follows: (1) demonstrate whether there is a difference in OI practices between companies that manufacture products and those that provide services. (2) identify the advantages, challenges and co-branding strategies that companies see, face and prefer when doing OI activities.

Open Innovation in Mexico

Librado González et al. (2016) found that only 9.6% of companies in the country innovate, and in terms of openness to knowledge, only 10.5% are open companies, meaning they use external knowledge intensively. However, this may have changed in the last decade.

Maldonado Guzmán et al. (2021), study OI in the automotive industry. Their work focuses on small and medium enterprises (SMEs). The authors do a quantitative study finding that not only sharing knowledge and abilities with their main commercial partners is possible, but collaboration activities with universities and public and private research centers is a common activity that eases the adoption and implementation of OI.

Other studies on OI in Mexico, specifically on SMEs, have linked it to a better financial performance. According to the Alvarez-Aros et al. (2022), horizontal collaboration, that is, between educational institutions, government and competitors, does result in a significant positive relation with financial

performance, being new product co-development, one of its outputs.

However, there may be barriers that make such collaborations difficult. For example, linkages between companies and local suppliers, usually smaller, may be difficult. As a result, the company's size has been largely studied as a relevant factor that determines the level of OI in a company.

In terms of services, according to Chesbrough (2010), a way companies can move towards OI is by working closely with customers to develop new solutions. However, there are barriers that services still face when trying to use OI, such as changing service pricing, adjusting sales compensation incentives, developing appropriate metrics and communicating service value. This is relevant if we consider that the services sector is a crucial component of the Mexican economy, which contributes to it gross domestic product and employment.

For example, in the tourism and hospitality industry, a study found that firms' OI performance had significant contributions to promoting service innovation and business performance (Hameed et al. 2021). According to their findings, both the internal knowledge and the external one influence OI performance. These authors also emphasize the very important role of intellectual property.

Co-branding activities

When companies develop new products or services, they choose the type of OI strategy that suits them best, whether a company seeks ideas informally from another one, involves it in its research and development activities, or is not open at all to collaboration. As a result, the levels at which a company collaborates with another, from letting the supplier do all development or taking only ideas from it, to fully developing a new product or service in collaboration, affect their co-branding strategy. A successful example of OI is the Apple Watch paired with Nike+, which helped them to provide new experience to customers, hence, adding value for both brands. In this case, the companies decided to launch the product by keeping both brands' names.

Pinello et al. (2021) summarize research on co-branding, finding that motivations behind co-branding alliances, the differences in performance between the paired brands and the emergence of spillover effects have been pillars of the marketing research agenda for almost three decades. That means spillover effects (or information leakages) have been of concern to researchers for a long time. It is interesting then to find out if companies still share the same concern.

One motivation for implementing a co-branding strategy is to penetrate a foreign market (Pinello et al. 2021). Other motivations include reinforcing a brand or extending it. The decision when developing a new product is then, whether to combine brands, unite brands or generate a new one (Chang, 2009).

Twenty-one semi-structured interviews were conducted with senior executives from a wide range of industries, including nine service-oriented companies and twelve product-focused firms, over a two-year period from September 2022 to October 2024. Participants were selected through convenience sampling and completed a ten-question instrument addressing open innovation practices. Closed and multiple-choice questions were examined using descriptive statistical measures, while open-ended responses were explored through keyword analysis supported by MAXQDA software to identify differences between service- and product-based organizations. The participating companies represent a diverse set of activities, spanning digital and technological services such as virtual and augmented reality, data intelligence, and e-commerce platforms, as well as the manufacturing of medical equipment, electronic components, automotive systems, pharmaceutical products, beverages, and agricultural and chemical goods.

Overall, most companies have done collaborations. An 89% of the service-based companies have done some type of collaboration. This is close to the 92% from the product-based ones who also report to have done so. Companies collaborate, by doing temporary, permanent, formal or informal collaborations. Managers reported having engaged in some type of collaboration, highlighting those

for data collection, connecting services and logistical support. Companies also seek external information to help them change or improve processes and products or to launch a completely new product or service together. Examples include collaborations with universities, suppliers, developers, other companies and start-ups.

Open innovation outward occurs when a company helps or provides information to others. In the case of certain technology companies, this type of innovation resulted in compatible products. This sector stands out for its collaboration with universities, as well as the production of medical equipment. In the automotive industry, there are more collaborations with suppliers, which allows for the development of ideas and joint launches. Companies use external information to find target markets, conduct research, do benchmarking and implement new processes. Table 1 summarizes the results of the questions relating to the use of external information for product development, and to information leaks experienced during collaborations.

Table 1. *Statistical results of information related questions for both groups*

Question	Category	Mean	SD
External information for product development	Service	0.66	0.5
External information for product development	Product	0.77	0.44
Information leakages	Service	0.33	0.5
Information leakages	Product	0.22	0.44

From Table 1 we can tell that there are no large differences between both groups, as a good number of both groups report to have used external information to develop new products (inward OI). The low mean for the second question in both cases, reflects the fact that few companies have experienced information leakages that could have been useful to their competitors. The use of confidentiality agreements is therefore common, and there are even technological measures to detect information infiltration. In the biotechnology sector this seems crucial as there is a fear that by demonstrating the functionality of their products, other companies will try to replicate them.

In terms of co-branding as a result of OI projects, respondents consider partnering with another company to: introduce a new product/service or an improved existing product by combining brands under a single name; explore new markets with a new product/service or an improved existing product by combining brands; and introduce a new product/service or an improved existing product while keeping each brand name separate. Table 2 summarizes such preferences for both groups.

Table 2. *Statistical results of co-branding related questions for both groups*

Question	Category	Mean	SD
Combining brands with single name	Service	0.22	0.44
Combining brands with single name	Product	0.45	0.52
Unify brands	Service	0.44	0.52
Unify brands	Product	0.54	0.52
Each brand separately	Service	0.5	0.53
Each brand separately	Product	0.1	0.31

Results indicate that both groups prefer unifying brands when launching a new product. It is also visible

that product-based companies are more open to combining brands with a single name (means of 045 vs 0.22). The largest difference is found in the third option (using each brand separately), as the means show that in the case of product-based companies, this is not common. Apparently, service focused companies value more the uniqueness of their brand and rely less on co-branding strategies that give emphasis to their collaborator.

Qualitative analysis

In terms of challenges, for product-based companies the word information stands out. Other frequent words are communication, product, service, guidelines, confidentiality, share, project and avoid. This means information and data confidentiality are among the challenges OI brings. Other obstacles to OI are good communication among companies, same as confidentiality agreements or guidelines when working on OI projects.

In the same line, for service-based companies, the word risk is the most frequent. Other salient words are client, enterprise, market, workshops, technology, product and pilot. It is interesting to see, that the word costs of collaborations appears among the challenges in this group. In addition, in many cases, workshops are necessary to make sure both companies and institutions are on the same track. Figures 1 and 2 depict word clouds on OI challenges of both groups.

Figure 1. Key words on challenges for product-based companies



Figure 2. Key words on challenges for service-based companies



However, costs are not only seen as a challenge to OI. A reduction in costs, when companies share infrastructure and risks involved in product launches, is certainly a benefit. Figures 3 and 4 depict the most frequent words when asked about advantages of OI.

For the product-based group, the words enterprise, collaboration, product, access, market and enterprise are among the most common. This shows that the access to new markets through OI is highly valued by this type of companies. Other advantages of OI are related to development, innovation, alliances, knowledge, improve, service, equipment, clients, company, improves and costs. Hence, not only the development of new products and services and access to new knowledge are relevant, but also the reduction in costs derived from OI activities, is also attractive.

Figure 3. Key words on benefits for product-based companies



In the case of service-based companies, a reduction in costs is considered a key advantage when doing OI projects. Other relevant words are enterprises, development, reduce, resources, collaboration, knowledge, risk, consultants, experience, clients, free, share, participation, success, projects and ideas. Benefits such as sharing knowledge, experience, resources and ideas help to lead to success. The high number of words of same size (and frequency) reflects the equal importance that managers give to such benefits.

Figure 4. Key words on benefits for service-based companies



Finally, the interviewees from both groups agree that the impacts of OI are related to development, enterprise, product, need, person and generate. These are followed by business, production, growth, knowledge, talent, collaboration, entity, client and cost. Managers agree that OI leads to growth, the access to knowledge and talent, and product developments.

Conclusions

While companies in both groups report to be have done collaborations, and use external information for product developments, we can tell there is still aversion to the risks that OI collaborations can entail, such as information leakages. This confirms the challenges to OI posed by Tidd & Bessant (2024). Companies are aware that they could lose important information when sharing it for collaboration purposes, and hence, use non-disclosure agreements when necessary. An important difference detected is that for product-based companies, the risk of losing information is key.

Efforts in terms of time, training and investment are part of OI challenges too. Also, opposed to the findings from Maldonado Guzmán et al. (2021), most collaborations with universities, in our study, were from the technology sector. In contrast, in the automotive industry there are more collaborations with suppliers.

In terms of advantages, no relevant differences between both groups could be detected. Both see a reduction in costs as a relevant factor to get involved in an OI project. Getting access to new markets, knowledge and experience are also a plus for all.

In terms of co-branding strategies, product-based companies are more open to unify brands and combine them than service-based ones. This may be related to the access to markets that another well-known brand can bring. It could also be related to the difficulty highlighted by Chesbrough (2011) for services in terms of communicating value and pricing accordingly. That is, a well-positioned brand is careful when choosing a co-branding strategy in order not to lose the reputation it has worked hard to achieve.

Both companies and governments in the country still have the opportunity of incentivising more OI. Despite that, results indicate that, compared to the numbers reported by Librado-González et al. (2016), OI activities are now more common. The lack of trust consequence of the challenges enterprises face could also be further studied by doing a quantitative analysis that identifies the factors that affect it, such as cultural issues and the country's specific current social and economic environment.

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Benefits of using social network X in the effectiveness of the food bank of the Foundations Affiliated with the Bogotá Food Bank

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Introduction

In the current context, marked by increasing digitalization, social media platforms have become essential tools for non-profit organizations to strengthen their communication with various audiences. These platforms enable the creation of meaningful connections, promote organizational transparency, and stimulate citizen participation (Levasseur et al., 2021; Wang & Yang, 2020), which is key to building public trust (Sun & Asencio, 2019; Grillo Torres & Moreno López, 2022).

In particular, digital social profiles offer strategic opportunities to encourage actions such as volunteering, manage awareness campaigns, and foster donations, with a reach that significantly transcends the virtual sphere (Boulianne, 2023; Bhati & McDonnell, 2020). Innovative strategies, such as the use of emotional narratives and immersive audiovisual content, have proven effective in capturing users' attention and significantly increasing their level of engagement with causes (Grillo Torres & Vega, 2024; Pérez-Seijo et al., 2018).

Within this framework, foundations affiliated with the Bogotá Food Bank play a crucial role in combating hunger and food insecurity. Their impact extends not only to the logistics of food distribution but also to strategic communication management, which is capable of mobilizing resources and strengthening community support networks (Seo & Vu, 2020; Grillo Torres et al., 2023).

In this regard, the social network X (formerly Twitter) has emerged as a particularly relevant platform for fostering interactive relationships with the public (Cartwright et al., 2021; Ihm, 2019). Its bidirectional nature enables third-sector organizations to actively engage with diverse audiences, expand their social reach, and reinforce their institutional positioning (Elvira-Lorilla et al., 2024; Mercado et al., 2022).

The primary objective of this study is to thoroughly evaluate how communication strategies on X, regarding formats, themes, publication frequency, and content quality, contribute to fostering reciprocal and meaningful interactions with audiences. The findings of this research provide relevant insights for optimizing digital communication in non-profit organizations, contributing to the development of effective practices in strategic social media management.

Theoretical Approaches to Understanding the Strategic Use of Social Media in the Third Sector

Digital social networks have transformed organizational communication, particularly within the third sector, by facilitating bidirectional relationships with diverse audiences. Their use enables not only the

dissemination of information but also the reinforcement of transparency, the promotion of participation, and the formation of support communities around social causes (Baladron, 2020; Castillo-De Mesa & Gómez-Jacinto, 2020).

Various studies have documented how NGOs in Latin America have adopted digital strategies to foster engagement, despite challenges such as limited connectivity and technological inequity (Ortiz Rodríguez, 2021; Cheyne et al., 2020). In these context, visual content, emotional narratives, and calls to action have proven particularly effective in capturing attention and mobilising users (Koutromanou et al., 2023; Saikia & Barman, 2023).

From a theoretical perspective, two key models stand out for analyzing digital engagement: Social Presence Theory, which emphasizes the perception of emotional closeness in communication (Rauniar et al., 2019; Grillo Torres, 2021), and the Social Media Engagement Model, which describes the user's progression from passive observation to active co-creation (Shawky et al., 2020; Rodriguez-Lozada et al., 2024). Both models agree that communication becomes more effective when rational and emotional strategies are integrated (Dolan et al., 2019; Cabrera-Cordova et al., 2023).

Additionally, recent studies have highlighted that publication frequency, the use of interactive formats, and message coherence are key factors in stimulating participation on platforms such as X. In particular, the inclusion of multimedia resources and hashtags, along with clear calls to action, enhances both visibility and institutional legitimacy (Taylor, 2023; Zhang et al., 2023).

In the case of food banks, research has highlighted the importance of integrating effective communication practices with logistical and technological models to maximize the impact of their interventions (Rizvi et al., 2021; Martínez & Ayala, 2024). Digital communication, therefore, not only disseminates institutional efforts but also acts as a catalyst for community engagement.

This conceptual framework supports the analysis of the strategic use of X by foundations affiliated with the Bogotá Food Bank, allowing for the identification of digital interaction patterns that may optimize their communicative performance and strengthen their social impact.

The Multiple Correspondence Analysis (MCA) revealed two main dimensions explaining 40% of the variability: the first associated with content types and formats, and the second with publication frequency and interaction. The graphical representation shows two foundation profiles: a majority group employing static strategies and exhibiting low interaction, and a minority group focused on audiovisual content, high frequency, and strong audience engagement.

The results confirm that foundations affiliated with the Bogotá Food Bank achieve more meaningful interaction on the social network X when they adopt dynamic communication strategies, including frequent posting, the use of visual resources, and the incorporation of calls to action. This finding reinforces the proposal made by Koutromanou et al. (2023) and Boulianne (2023), who highlight the effectiveness of emotional and audiovisual content in fostering engagement within non-profit organizations.

The Multiple Correspondence Analysis allowed for the identification of two differentiated profiles: one predominantly static, characterized by low activity and limited interaction, and another more active, with practices oriented towards participation. This segmentation supports the Social Media Engagement Model (Shawky et al., 2020), which distinguishes between different levels of digital engagement based on the quality and frequency of content.

Likewise, the Kruskal-Wallis test and the Chi-squared analysis confirmed that publication frequency and communicative quality have a significant impact on the level of interaction. However, there was considerable variability among posts even within active groups, suggesting that frequency alone is not sufficient: content must be strategic and tailored to the audience.

Among the study's limitations are its cross-sectional design, which prevents the establishment of causal relationships, and its exclusive focus on the X network, which limits the generalizability of the findings to other digital environments. Furthermore, the analysis did not include qualitative metrics regarding audience type or the emotional effects of content.

Future research could address these gaps through longitudinal studies and mixed methods approaches, incorporating interviews or qualitative content analysis to gain a deeper understanding. It would also be helpful to compare communicative performance across other platforms (such as Instagram or TikTok) and explore the impact of emerging technologies, such as personalization algorithms, on citizen engagement.

Conclusions

This study demonstrates that nonprofit organizations affiliated with the Bogotá Food Bank (Banco de Alimentos de Bogotá) effectively enhance digital engagement on the social network X (formerly Twitter) through participatory communication strategies. The frequency of publication, use of visual and interactive formats, and integration of strategic calls to action are significantly associated with higher engagement levels, contributing to increased institutional visibility and strengthened community relations.

Multivariate analyses, including Multiple Correspondence Analysis (MCA), Chi-square, and Kruskal-Wallis tests, revealed significant associations between communication variables and interaction metrics. Organizations employing more dynamic communication approaches exhibit a greater potential to consolidate support networks, reinforce legitimacy, and increase organizational sustainability.

From a strategic perspective, the findings highlight the importance of incorporating emotional and visual content into social media profiles and maintaining a consistent online presence. These practices facilitate broader audience reach and foster stronger, reciprocal relationships with stakeholders.

It is recommended that future research employ longitudinal designs and mixed-method approaches to better understand the evolution of digital engagement, compare communicative effectiveness across different platforms, and evaluate the role of technological tools—such as recommendation algorithms—in shaping audience interactions.

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Mental health impacts among healthcare workers involved in an adverse event in Colombia

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This text was written as part of a project entitled "C124-300-6413 Perception and factors related to stress, depression, anxiety, resilience, sleep disorders, and support for secondary victims of an adverse event in Latin America in 2024-2025," carried out by the Minuto de Dios University Corporation.

Introduction

Since 2000, the concept of secondary victims has been reported in the scientific literature, when Dr. Albert Wu, a researcher at Johns Hopkins University, coined it in a publication in which he described an adverse event involving a healthcare professional and the impact on healthcare personnel in this situation (Catalán et al., 2024; Scott et al., 2009; Wu, 2000). In this sense, the phenomenon of secondary victims is understood as the negative impacts suffered by healthcare personnel who are directly or indirectly, and unintentionally, involved in an adverse event (Gonzalez Delgado et al., 2023; Vanhaecht et al., 2022).

The prevalence reported in studies on the occurrence of adverse events worldwide is 10% in hospitalized patients and 4% in primary care patients. These figures represent the frequency of occurrence of events in patient safety, bearing in mind that similar figures could be presented for secondary victims (Catalán et al., 2024; Organización Mundial de la Salud, 2023). In studies conducted in Colombia on this phenomenon, there are few publications in which a prevalence of secondary victims of 33.8% was found, and medium to high stress levels of 21.9% were reported (Gonzalez Delgado et al., 2023); another study reported a prevalence of 99% among those who had been involved in an adverse event, identifying themselves as secondary victims (Flórez et al., 2022). On the other hand, it has also been studied in health sciences students, with a prevalence ranging from 62% to 85% in nursing students (Catalán et al., 2024). Among the negative impacts on secondary victims after being involved in an adverse event reported in the literature at the psychosocial and mental health level are: anxiety, depression, stress, hypervigilance, lack of concentration, mental fog, and even manifestations such as sleep disorders and flashbacks (Bjereld et al., 2024; Catalán et al., 2024; Flórez et al., 2022; Gonzalez Delgado et al., 2023; Norvell et al., 2024). This situation can be exacerbated by the recent effects of the COVID-19 pandemic on the mental health of healthcare workers and the general population, with depression continuing to be one of the main mental health disorders impacting the general population and being more frequent in women (Salud Mental - OPS/OMS | Organización Panamericana de la Salud, n.d.). Considering that approximately 15% of working-age adults experienced a mental health disorder in 2019, it is estimated that this situation

results in the loss of about twelve billion workdays due to anxiety and depression within this population (Organización Mundial de la Salud, 2024). Similarly, elevated levels of resilience have been considered a protective factor for the mitigation and management of mental health effects in the general population, and especially in healthcare personnel (Aron et al., 2021). Therefore, the objective of this study was to analyze the prevalence of anxiety, depression, and resilience in health workers involved in an adverse event in Colombia during the period 2017 to 2025.

Sociodemographic and work-specific characteristics

The instruments were answered by 138 members of the human talent in health in Colombia. Of the sample, some of the sociodemographic characteristics of the participants were: 39.9% (n=55) were in Bogotá; mostly single 46.4% (n=64); 39.9% (n=55) with technical and technological education; 31.9% without children (n=44); head of household 61.6% (n=85); middle socioeconomic stratum 76.1% (n=105). Regarding the variables specific to the work, it was found that the average work experience was 14.8 years (±9.3), with a seniority in the current job of x̄ = 6.2 years (±7.6), lifetime work experience in the health sector x̄ = 13.8 years (±9.0), hours of work per usual day x̄ = 8.8 (±2.9), hours using devices x̄ = 7.8 (±10.4).Similarly, in terms of occupation, 37.7% (n=52) were mainly nursing technicians/auxiliaries; 60.9% (n=84) take active breaks; 47.8% (n=66) use a computer; 42.8% (n=59) have fixed/contract/provisional contracts; 76.8% (n=106) use PPE; and 60.9% (n=84) work in a private institution. The results showed a prevalence of having been involved in an adverse event (secondary victims) of 15.9% (n=22); severe anxiety 8.7% (n=12); and severe depression 5.1% (n=7); and resilience 39.9% (n=55).

Factors associated with anxiety, depression, and resilience in health workers

In the bivariate analysis, a statistically significant association was found between the phenomenon of secondary victims and nursing professionals (OR= 3.03; CI: 1.17-7.83), moderate anxiety (X2= 10.79; 0.00), anxiety (OR= 4.25; CI: 1.61-11.25) (X2= 9.42; P=0.00), moderate depression (X2= 9.92; P=0.02) 1a = 5 polling stations (50.0%) expected a count less than 5; OR= Odds Ratio; Ll = Lower limit; Ul= Upper limit; Chi = Pearson's chi-square; P= Sig. Bilateral. NA= Not applicable. In this sense, in the binomial regression to estimate the risk, there was evidence of a relationship between secondary victims and nursing professionals (OR = 39.30; CI: 1.28–1208.51; p = 0.04), nursing technicians (OR = 44.22; CI: 2.49–785.66; p = 0.01), moderate anxiety (OR = 0.00; CI: 0.00–0.50; p = 0.03), and the sum of depression (OR = 1.22; CI: 1.010–1.48; p = 0.04)

Conclusions

The prevalence reported by human talent in health involved in an adverse event (secondary victims) in the study was 15.9%, which is lower than that reported in other studies worldwide, which exceed 60% (Catalán et al., 2024; Flórez et al., 2022; Gonzalez Delgado et al., 2023; Khodriss et al., 2025; Potura et al., 2023). Regarding the presentation of the phenomenon of secondary victims, one study described, for example, mental load as exhausting and doubting professional skills (44.9%) as the main impact (Khodriss et al., 2025). In turn, a study conducted on mental health personnel showed that they were more hypervigilant, took more notes, and paid more attention to detail in patients who presented suicidal ideation disorders (Pérez-Solà et al., 2024). On the other hand, a literature review found that psychological distress and symptoms such as anxiety, loss of self-efficacy, stress, and depression were the main effects observed in secondary victims among nursing staff, a situation like that in this study (Sahay & McKenna, 2023). As in this study, professional experience was not a factor in the occurrence of adverse events or in the development of skills to cope with the negative impacts on the mental health of secondary victims (Potura et al., 2023). In this regard, one aspect to highlight is the low

prevalence of resilience in the surveyed health personnel, which contrasts with what has been reported in other studies, where resilience levels were higher and associated with better mental health outcomes for health workers (Labrague, 2021). Thus, regarding the occurrence of anxiety and depression in health workers, a systematic review reported a prevalence of depression of 21.7% and anxiety of 22.1%, both higher than those found in the present study (Li et al., 2021). Among the limitations of this research are those inherent to the type of sampling used, in which, being a non-random sampling, the results cannot be generalized to the population of health sector workers (Otzen & Manterola, 2017). Likewise, the study's contributions to the field of patient safety and occupational health and safety include revealing the prevalence of mental health disorders in healthcare workers who have been involved in adverse events, which will facilitate the design of psychosocial risk surveillance systems in which the phenomenon of secondary victims is recognized within the framework of healthcare institutions, as well as interventions targeting the factors contributing to the occurrence of adverse events. In conclusion, it should be noted that the phenomenon of secondary victims is a tangible, significant, and multifactorial reality in the field of health.

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The violation of the political rights of native communities

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Introduction

This study aims to analyze the violation of the political rights of indigenous communities based on the jurisprudence of the Inter-American Court of Human Rights, which has been systematized in the last two decades of this century.

In the historical context, after the colonization of the indigenous or native peoples of Latin America, the Spanish or Portuguese imposed their political and cultural power. This historical development led to rape, genocide, marginalization, discrimination, and the violation of the rights of indigenous peoples. In this process, beliefs with European and native roots were practiced, achieving social cohesion and stability (León, 2024).

Then, after gaining independence from Spain, the indigenous or native cultures of Latin America have sought to emancipate themselves, taking into account their pluricultural, plurinational nature, which highlights the emptiness of the Western hegemonic system to value or promote respect for human rights (León, 2024).

At another point in history, during the process of coloniality, the beliefs, knowledge, language, and norms of Indigenous peoples were eliminated so that they could later establish their political, economic, and legal systems, respectively (León, 2024). In this context, the valorization or recognition of political (and social) rights is sought in order to enjoy political and cultural autonomy and thus achieve social justice (Pino, 2024). Within this framework, the jurisprudence of the Inter-American Court is analyzed, which demonstrates the violation of the political rights of Native communities and which has been resolved after many years of litigation.

Problems that the communities face

Some studies highlight certain problems faced by Indigenous peoples; for example, they lack participation in decision-making; they also have limited access to healthcare and a life expectancy 20% lower than that of non-Indigenous individuals. On the other hand, there are no studies that reflect or conduct a comprehensive analysis of Indigenous peoples' political rights regarding self-determination, participation in collective or public decision-making, and the establishment of measures to regulate their political rights (Kovalchuk et al., 2023).

In other cases, the exclusion or limited participation of indigenous women in politics is reported due to paternalism, the actions of political parties, and the lack of recognition of the political rights of Indigenous peoples that take into account a gender perspective. In this context, the political exercise of these communities or peoples is proposed, with women also taking center stage (Rey, 2014).

Indigenism in Latin America, at the beginning of the last century, and still prevalent today, has faced legal, cultural, and social problems. Addressing or resolving these challenges seeks to consolidate its own identity, taking into account its diverse legacies and traditions (Cubas and Santa María, 2023). The impact on the political rights of leaders and communities is also evident.

In the contemporary context, the development of neoliberal policies, investment projects, and extractive industries has generated social and cultural tensions that have led to the politicization of the identity of the Indigenous population. Therefore, States must create legal instruments to promote and

protect the rights of these peoples (Cárdenas and Vallejos, 2022). In this case, political rights that safeguard the collective interests of communities must be consolidated.

The political rights

Political rights, which are found within human or fundamental rights, consist of participation in political affairs that derive from sovereign power, that is, from the people, and allow citizens, jointly, to manage or solve public issues directly or through some representatives who have been democratically elected (Chirinos, 2013).

The Inter-American Court argues that political rights, reflected or established in the American Convention, consolidate democracy and political pluralism that are related to other rights such as freedom of assembly and association (Farfán et al., 2024).

On the other hand, political rights are not separated or isolated from the roots of ancestral lands and environmental resources that make up their common heritage, although they also face problems such as the dispossession of their lands or resources by certain mining companies (Odimba, 2017).

Likewise, political rights must consider the traditions of Indigenous peoples, as well as the forms of their self-government, since these vary among communities (Odimba, 2017). Likewise, the political participation of Indigenous communities must take into account their cultural reality or identity, which is framed within the principles of equality, without discrimination among members of these populations, in order to consolidate a democratic system (Salmón, 2010).

Proposals

Some proposals postulate a political subject that consists of recognition as an Indigenous people; its construction must emerge from the movements themselves and position their demands within a context where their rights are recognized from local to global or international institutions (Pedraza, 2020).

Other proposals are given from planning or life plans that allow Indigenous peoples to evaluate and reflect their own future. In this case, they must project their actions through collective dialogue in order to assume or be at the forefront of social and historical changes. Other aspects intertwined with projects or life plans are the consultation and decision-making processes that must take place within the Indigenous population itself; this way, they consolidate an Indigenous political community headed by Indigenous leaders and authorities (Espinosa, 2014). Added to this are other proposals related to the formation of defenders of the political rights of the communities, who must be familiar with Indigenous culture and the respective political system (Odimba, 2017).

Some more recent proposals establish that countries generate regulatory instruments and diverse institutional frameworks for Indigenous peoples, as this situation does not yet exist or is not yet present. However, a first approach to this is the creation or consolidation of Indigenous collective rights that are related to political rights (Becerra, 2022).

In Latin American scenery (such as Mexico), the political and electoral rights of indigenous communities have been recognized, and in this context, legal pluralism, the interests and values of indigenous peoples must be taken into account to establish an intercultural dialogue, and this way strengthen indigenous legal systems so that they have effective political representation (Miranda, 2020).

From the perspective of critical discourse analysis, the abuse of power that establishes social structures and relationships between groups is studied. From a social perspective, or component, this abuse involves the power of dominant groups over dominated groups, who maintain a certain resistance. In this context, public discourse is controlled by leaders who dominate politics, the media, and business (Van Dijk, 2016). This dominance or control of discourse also involves or takes into account the creation

and control of laws, which in this case are concentrated in the State.

In this context, it is evident that various States have exercised control (through laws or regulations) over the leaders of indigenous communities, who have been deprived of their political participation. However, the actions of the Inter-American Court have made it possible to remedy the violation of this right. However, this becomes a problem since they have had to wait a considerable amount of time for their rights to be restored or resolved.

Legal basis

The Court refers to the American Convention, specifically Article 23, which addresses political rights. These rights consider citizens' participation in public affairs, as well as the right to vote or be elected through universal suffrage. They also have equal access to public office. In this context, the internal norms of States must be consistent with the provisions of the Convention in order to avoid violations of the political rights of indigenous communities.

In this framework, customary law is taken into account, which is also violated in some cases, because it infringes on the customs of indigenous peoples because the rules of some States do not consider them.

Analysis of the problem

The recurring problem is the exclusion or marginalization of community leaders from political participation. For example, the problem of the exclusion of candidates from indigenous communities, who have been prevented from political participation for mayor, vice mayor, and council members through the regional indigenous political party Yapti Tasba Nanih Asla Takanka (YATAMA). In this process, the party was excluded, and the State ignored the electoral laws that allow representatives of indigenous organizations to participate (IACHR, 2005). This excluded representatives of these communities from political rights, specifically on November 5, 2000.

Likewise, in another case, the forced disappearance of the Mayan indigenous political leader Florencio Chitay occurred in 1987. He received threats while serving as mayor of the municipality. In this case, the State of Guatemala violated, among other rights, the right to political rights. His family was also affected, as his children, due to forced displacement, lost their culture, traditions, and language (IACHR, 2010). On the other hand, the problem of the implementation of penalties that violate the political rights of some leaders is evident, which also violates Article 23 of the American Convention (IACHR, 2014).

Likewise, in the case of the Agua Caliente Mayan Indigenous Community, opposite Guatemala, it is considered that its political rights have been violated since the State has not consulted the community or population on the exploitation of natural resources (specifically mining activity) that belong to them, following the pertinent procedures through representative institutions (IACHR, 2023).

Role and relationships of the protagonists in the process

In the case of the protagonists, there is an asymmetry among them. It is evident that the States violate the rights of the communities who are the victims due to their exclusion from political participation. There is an abuse of power by the States against Native communities through the imposition of certain laws.

This asymmetry of power is balanced, although late, by the intervention of the Commission, which brought the case before the Inter-American Court, which ultimately ruled in favor of the indigenous communities whose representatives have been excluded from political rights that directly affect democratic processes and decision-making (IACHR, 2005). Similarly, there is unequal treatment in the

case of the indigenous mayor of Guatemala against the power of the State, which accepted responsibility only after the incident was brought before the Court; in this case, the Court functions as a balancing body between the powers or abuses committed by States (IACHR, 2010). Likewise, there is inequality between the victims and the State of Chile, which, through certain arbitrary laws, has deprived community representatives of their freedom (IACHR, 2014). Furthermore, the State imposes its will without considering the prior consultation that must be carried out to exploit the natural resources of indigenous communities, based on the American Convention (IACHR, 2023).

The context or reality of the communities or towns

The context in which Native communities live is not only one of social and economic exclusion or discrimination, but also marginalization from participation in politics and democracy, preventing Native community leaders from freely participating in these activities for their development. Furthermore, the cultural richness of the communities and their diverse languages is highlighted (IACHR, 2005). Certain communities are integrated, cohesive, and stay united, showing solidarity when sharing their culture, customs, and democratic actions that pursue a collective interest (IACHR, 2010). Native communities' progress and development look affected because their representatives are prevented from participating in democratic actions or representing their communities (IACHR, 2014).

In addition, native communities conserve their natural resources as a cultural tradition and live together in harmony with them. The communities consider them as a subject. However, in this case, it is evident that the State breaks this tradition by allowing the exploitation of resources, specifically mining, without the prior consultation required in accordance with the international standards of the Convention (IACHR, 2023).

Abuse of Power

The abuse of power is evident on the part of States, which, in an arbitrary and even authoritarian manner, violate the rights of communities by legally preventing them from participating in democratic activities or from electing or being elected, as seen in the cases analyzed. States issue norms or laws that affect the customs of communities; they also show a disharmony between internal norms (of the States) and those of the American Convention.

The 2000 electoral law did not contemplate the status of popular subscription associations, aspects that were included in the electoral laws of 1990 and 1996, an aspect that excluded them from the process. The 2000 law only allows them the legal status of parties, which is not specific to the communities. Besides, electoral laws are published in Spanish and not in native languages, an aspect that highlights their exclusion (IACHR, 2005).

In the case of Florencio's disappearance, the State has acted intentionally or deliberately by preventing this leader from participating in democratic activities on behalf of his community where he was trained to contribute to its development (IACHR, 2010).

Abuse of power is manifested through the application or imposition of criminal laws, as in the case of Chile, where perpetual disqualification from public office or positions and political rights have been established (IACHR, 2014). Abuse of power is also evident when the State fails to respect prior consultation for the exploitation of mineral resources, as in the case of the Agua Caliente Indigenous Community in Guatemala (IACHR, 2023).

The resolution of the conflict

The Court has resolved favorably on the violation of the political rights of communities and ordered States to compensate for damages and pay costs, as well as to make compatible their internal norms with those of the Convention (IACHR, 2005). Also, it ordered the State to recognize the victim and also

assume medical and psychological treatment for the victim's family (IACHR, 2010). On the other hand, the Court has established a series of reparations that involve measures, guarantees, and compensation (IACHR, 2014). Finally, reparations are specified regarding restitution measures (titling, demarcation, etc.), satisfaction measures (publication and dissemination of the judgment), guarantees of non-repetition, and the respective compensation (IACHR, 2023).

Conclusions

It is concluded that, according to the analyzed cases, the States have violated the political rights of indigenous leaders or communities, contravening the provisions of the American Convention. Likewise, the discordance between the norms of the States and those of the Convention is evident.

The abuse of power by States is also evident, as they impose laws that condition or violate the exercise of political rights, denying the democratic participation of their representatives, and that this not only alters these rights but also the development or growth of their own communities, while also affecting their traditions, their culture, and their way of organizing, which has been consolidated in the course of history.

Likewise, there is historical evidence of discrimination against Native communities, who are excluded or marginalized not only socially or politically, but also legally, denying them democratic participation in the development of their Native communities. Added to this is gender-based exclusion as, in some cases, women are excluded from participating in electoral activities, as reported in previous studies.

Finally, it is evident that the communities or representatives of the native communities only achieve justice through the Inter-American Court, but only after several years of agonizing struggle.

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Affective Interaction and Subjective Well-Being in Precarious Labor Contexts: An Interpersonal Communication Analysis of Working Women in Mexico

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Introduction

In the Mexican context of work, women are overrepresented in unstable jobs with low earnings and few institutional supports. Such precariousness has important implications for women's economic well-being and psychological health and subjective well-being (OECD, 2020). Nevertheless, studies of public health and social policy have tended to focus on structural determinants of precariousness (eg, income, occupation, educational attainment) to the exclusion of communicative and affective dimensions to everyday experience.

However, new research reveals that in contexts of limited structural support, the quality of interpersonal communication (eg, emotional responsiveness, trust, conversation frequency) can have a greater predictive power for life satisfaction than the formal structure of social networks (Delhey & Dragolov, 2016; Reis & Gable, 2015; Itzchakov & Reis, 2023) This research assumes that in precarious settings, affective interaction operates as a buffer mechanism that fosters resilience and subjective well-being.

Instead of focusing on size or institutional embeddedness of social capital, the study focuses on subjects' perception of these experiences, in particular the communication processes that convey recognition, support and affect. Social epidemiology and communication theory literature supports the contention that everyday emotional, recognition, and support exchanges—such as being listened to, communicating joy, and having frequent interactions—play a significant role in emotional regulation and life evaluation (Greene & Burleson, 2003; Koudenburg *et al.*, 2013; Ryff & Keyes, 1995). These dynamics are particularly important for women, who, due to their economic marginalization and gender roles, are more likely to experience chronic psychosocial stress.

Moreover, in situations of Studies have shown that perceived trust, solidarity, and conversational flow contribute not only to individual but to collective well-being (Kawachi *et al.*, 2008; Veenstra, 2000; Veenhoven, 2000). From this perspective, interpersonal communication is not an extra, but a core element of well-being, especially for women balancing informal labor and domestic responsibilities. Precarious labor environment, affective interaction not only has a psychological function, but a social validation function.

The present research explores how affective dimensions of communication relate to subjective well-being and perceived mental health in Mexican working women. Based on microdata from the 2024 BIARE survey, this analysis aims to test the hypothesis that trust, frequency of dialogue, and emotional positivity are better predictors of life satisfaction than demographic and socioeconomic variables. The analytical approach builds on the premises of social capital theory, studies on interpersonal communication, and subjective well-being (Kawachi & Berkman, 2014; Villalonga-Olives & Kawachi, 2017; Montero *et al.*, 2008). It will also contribute to the reconceptualization of well-being within a gender-sensitive and relational framework.

The approach is particularly relevant to Latin American contexts and other regions of the Global South where structural constraints limit the extension of traditional welfare models. The results will provide

empirical evidence that can support the formulation of public health policies that prioritize affective communication and interpersonal trust as fundamental determinants of women's wellbeing.

This research aims to examine the relationship between affective-interpersonal communication and subjective well-being in the context of Mexican working women exposed to precarious labor conditions. Specifically, the study proposes a model in which interpersonal trust, frequency of emotional dialogue, and perceived health function as key predictors of life satisfaction—over and above traditional sociodemographic variables such as age, education, and civil status.

The core objectives of this investigation are:

1. To assess the strength and direction of correlations between affective communication indicators (trust, emotional interaction, and conversational frequency) and subjective well-being measures (life satisfaction and positive affect) in working women over 18 years of age.
2. To test the predictive capacity of affective and communicational variables—using multiple linear regression—on overall life satisfaction.
3. To contrast interpersonal factors with structural variables (e.g., age, education, perceived health) in their association with subjective well-being, in order to evaluate the relative weight of communicational quality in precarious social environments.
4. To contribute empirical evidence to a gender-sensitive redefinition of subjective well-being that incorporates relational and communicative components, with implications for public health and labor policy in the Global South.

These objectives are grounded in a theoretical framework that recognizes the mediating role of interpersonal processes in well-being (Reis & Gable, 2015; Itzchakov & Reis, 2023), particularly in societies with insufficient institutional protections for women workers. In line with this, the research does not only seek to identify statistical associations but also to support a paradigm shift: from viewing social networks as structural entities to understanding them as lived, affective interactions with measurable influence on psychological health.

This study is grounded in an interdisciplinary framework that integrates interpersonal communication theory with the analysis of subjective well-being, particularly within the context of gendered labor precariousness in Mexico. Rather than reducing well-being to a matter of individual psychology or economic achievement, this approach sees it as a result of interpersonal processes, shaped by affective communication and the quality of everyday social exchanges.

Subjective well-being – often operationalized as an amalgam of cognitive evaluations (e.g., life evaluation) and affective experiences (e.g., frequency and intensity of positive and negative emotions) – has traditionally been seen depending on material or structural factors. Yet, more recent perspectives emphasize the emotional responsiveness and perceived relational support as major sources of psychological well-being (Ryff & Keyes, 1995; OECD, 2020).

Interpersonal responsiveness, understood as the experience of being listened to, valued and emotionally supported, has been shown to strongly impact emotional regulation and well-being outcomes (Itzchakov & Reis, 2023; Reis & Gable, 2015). In precarious labour contexts, where institutional guarantees are weak or absent, such relational attunement can work as a critical psychological resource to resilience and perceived quality of life.

Also the notion of social capital provides a useful consideration – and particularly in its horizontal dimension, trust, reciprocity and solidarity among peers and communities. These factors have been shown to not only be associated with better health outcomes (Kawachi & Berkman, 2014), but also higher levels of subjective well-being (Kawachi, *et al.*, 2008). In contexts where formal support is limited or absent, the networks of peers and communicative trust provide the compensatory mechanisms.

Other concept from communication studies points to the notion of conversational flow and social synchrony, where the rhythm, frequency and perceived ease of interactions contribute to group cohesion and individual affective stability (Koudenburg *et al.*, 2013). When such an interaction runs smoothly and emotionally supported, people experience more togetherness and well-being as well.

This is in line with Delhey and Dragolov (2016), who argue that social cohesion is one of the most important determinants for happiness, especially when it is given as affectional attachments as opposed to formal ties. Their analysis shows that feeling integrated, supported and emotionally connected within a community had direct impact on life evaluation.

Finally, this approach absorbs the perspective that quality of life is not only a matter of individual attributes, but a multi-dimensional phenomenon, based on relational goods, as proposed by Veenhoven (2000). Accordingly, subjective well-being should be measured not only through individual-level indicators, but by examining the communicative and relational dynamics sustaining emotional functioning. The present study advances this line of inquiry by testing a model in which interpersonal communication, trust, and emotional states serve as key predictors of well-being in a population historically underserved by social policy.

The descriptive analysis of 560 adult women employed or supporting a family business (BIARE, November 2024) revealed consistently high levels of subjective well-being. These figures reflect a broadly positive assessment of circumstances within the person's environment and inner life. In addition to high life satisfaction scores ($M = 8.63$, $SD = 1.77$), participants also reported elevated satisfaction with their free time ($M = 8.78$, $SD = 1.66$), with their city of residence ($M = 9.48$, $SD = 1.20$), and with their country ($M = 9.06$, $SD = 1.44$). These values reinforce the overall pattern of positive subjective well-being across both individual and environmental domains. Emotional indicators showed a degree of affective ambivalence: daily joy (7.05) co-occurred with concern (6.55) and sadness (6.38), conditions not uncommon for employed persons tending to multiple commitments.

Perceived social support also scored highly across all domains: community support (8.68), friendships (8.48), and family ties (8.26). These results suggest a robust relational safety net, which literature consistently identifies as essential to well-being (OECD, 2020). Spearman correlations confirmed strong positive associations between life satisfaction and support from friends ($\boldsymbol{\rho} = 0.43$), community ($\boldsymbol{\rho} = 0.44$), and family ($\boldsymbol{\rho} = 0.38$), underscoring the psychosocial significance of interpersonal ties.

Emotional well-being also displayed relevant associations: joy correlated moderately with satisfaction indicators ($\boldsymbol{\rho} = 0.24$–0.27), while concern and sadness had weaker inverse correlations. These trends align with established models of psychological well-being and emotional functioning (Ryff & Keyes, 1995; OECD, 2020) where positive emotions enhance evaluative judgments, and negative emotions undermine them.

Age, by contrast, showed no significant associations with well-being, emotional, or support indicators. The highest correlation, with joy ($\boldsymbol{\rho} = 0.078$), was statistically negligible, suggesting age is not a decisive factor within this cohort.

A multiple regression using life satisfaction as the dependent variable yielded a modest but significant model (adjusted $R^2 = 0.036$, $F = 4.04$, $p < .001$). The only significant predictors were joy ($\boldsymbol{\beta} = 0.091$; $p = .008$) and support from friends ($\boldsymbol{\beta} = 0.265$; $p < .001$), indicating that emotional positivity and peer relationships are key drivers of life satisfaction. In contrast, support from family or community, concern, sadness, and age did not show significant predictive power.

Further analyses reinforced these results. Family support ($\boldsymbol{\beta} = 0.24$; $p < .001$), perceived community care ($\boldsymbol{\beta} = 0.22$; $p < .001$), and general trust ($\boldsymbol{\beta} = 0.18$; $p < .01$) significantly predicted life satisfaction, explaining 28.3% of its variance. For emotional balance, family support ($\boldsymbol{\beta} = 0.27$; $p < .001$) and community friendliness ($\boldsymbol{\beta} = 0.21$; $p < .01$) were significant, explaining 24.9% of the variance. These patterns reflect key tenets of contemporary psychosocial theory (Ryff & Keyes 1995; Kawachi &

Berkman, 2014), highlighting the salience of relational quality and affective climate over demographic attributes. High-quality interpersonal communication, particularly attentiveness and friendliness, was a salient feature of well-being and effective emotional management, consistent with findings by Itzchakov and Reis (2023) on the psychological costs of non-responsive communication.

Negative affect indicators, such as sadness and worry, were negatively correlated with interpersonal trust (ρ = -0.32, -0.29, respectively), illustrating trust as a buffer against emotional strain (Kawachi *et al.*, 2008). These findings align with models of horizontal social capital and conversational flow (Koudenburg *et al.*, 2013) which diffuse interpersonal tension and emotional balance.

While causality cannot be inferred due to the cross-sectional design of this study, the consistency and strength of the associations lend credence to the hypothesis of affective interdependence. The results are consistent with Veenhoven's (2000) depiction of life quality as relationally anchored and multidimensional, which takes on added significance for precarious labor environments where emotional and social bonds become pivotal resources for well-being.

Conclusions

This study provides empirical confirmation that in precarious labor settings, the quality of affective and interpersonal communication is a more consistent predictor of subjective well-being than structural or demographic variables. The data show that life satisfaction is more closely associated with moderate levels of emotional joy and perceived support from friends than with factors such as age or education, which exhibited no significant association. This reorients the understanding of well-being away from individual or material indicators and toward relational and emotional dimensions.

The moderate correlations between perceived support (particularly from friends and community) and subjective well-being underscore the relevance of peer-based networks in contexts where institutional guarantees are weak or absent. The fact that community and familial support were not significant predictors in the primary regression model, despite moderate correlations, suggests that the emotional salience of friendship-based interactions may carry greater weight in shaping women's evaluations of their lives.

In addition, the inverse associations between trust and negative emotions point to interpersonal trust as a psychological buffer, capable of modulating emotional vulnerability even when formal support structures are lacking. This positions trust not only as a social indicator but as a mechanism of emotional regulation in the face of chronic occupational and domestic stress.

The study further demonstrates that communicative indicators—such as being heard, feeling emotionally connected, and engaging in positive interpersonal exchanges—contribute meaningfully to emotional stability. These findings validate the inclusion of affective communication as a measurable dimension in public well-being assessments and suggest that women develop adaptive emotional resources in their immediate environments when institutional conditions are insufficient.

From a public health and policy perspective, the implications are clear: improving women's well-being in precarious labor environments requires more than economic instruments or individual coping models. Interventions must also prioritize affective and relational aspects, including the reinforcement of trust networks, emotional expressiveness, and supportive peer interactions. Such strategies hold particular relevance for labor policies aimed at women in the Global South, where formal protections are often delayed, fragmented, or inaccessible.

Ultimately, this study contributes to a reconceptualization of subjective well-being as a dynamic outcome of affective interaction. By demonstrating that emotional and communicative variables explain greater variance in well-being than age or formal education, the results support a paradigm that centers relational processes—rather than structural conditions—as key levers for psychological stability and life satisfaction in contexts of labor vulnerability.

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Education and inequality: differential economic returns in Colombian cities

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Introduction

Metropolitan areas in Colombia play a central role in the country's economic development, serving as genuine hubs of employment opportunities. This analysis aims to examine the impacts of education in these areas, specifically those most relevant to the Gross Domestic Product (GDP) of the State of Colombia (Departamento Administrativo Nctional de Estadística - DANE, 2022). The goal is to understand how investment in academic training affects individuals' professional trajectories and economic indicators. "Returns to education", from the perspective of human capital theory, refer to the economic and non-economic benefits derived from educational investment (Becker, 1983), especially in the context of Colombia's metropolitan areas, where these returns can be significant and vary based on educational levels and employment sectors (Gómez *et al.*, 2015).

In these urban areas, a diversity of educational institutions is identified, ranging from local schools to prestigious universities (Gómez, 2013). Although access to higher education is generally more accessible than in rural areas, challenges related to equity and educational quality persist. This context establishes the necessary framework for understanding returns on education investment in the metropolitan labor market (Álvarez et al., 2021; Basten & Haamann, 2018).

Individuals who invest in education in metropolitan areas experience substantial economic returns, especially in high-demand sectors such as technology, finance, and health (Salcedo, 2013). The connection between higher education levels and higher salaries is palpable, standing out in a highly competitive metropolitan labor market that favors those with specialized skills and advanced academic training (Vera & Blanco, 2019). Higher education not only expands job opportunities but also facilitates access to roles of greater responsibility. Professionals with university degrees have greater chances of leading and participating in innovative sectors, contributing to dynamism and innovation in these urban areas (Rodríguez, 2016).

The central hypothesis of this article asserts that investment in education in Colombia's metropolitan areas generates significant returns in terms of income, labor mobility, and professional development. It is anticipated that this relationship between education and career success will be more pronounced compared to non-metropolitan areas, given the greater competitiveness and diversity of opportunities present in these urban environments.

Finally, the guiding question for this research is as follows: How is the relationship configured between investment in education and economic returns, labor mobility, and the impact on competitiveness, innovation, and sustainable development in Colombia's metropolitan areas, considering the dynamics of these urban environments and their influence on the construction of professional trajectories and the socio-economic development of individuals?

The results derived from the application of the Heckman procedure (1979) for the male subsample reveal patterns like those obtained for the female subsample (Rosero & Gómez, 2025; Gómez, 2014). Firstly, the lambda coefficients (3) indicate an absence of selection bias. Additionally, a statistically significant negative correlation at the 1% level is observed in the selected variables, suggesting that unobserved characteristics such as motivation, skills, and other attributes associated with productivity play a crucial role in determining individual incomes (Gómez & Barbosa, 2014; Schultz, 1961).

The results revealed a marked gender gap: men obtain significantly higher educational returns than women, even with similar levels of education. Bogotá had the highest returns, followed by Medellín and Manizales, while regions such as the Caribbean and Pacific regions showed lower benefits. This disparity is attributed to labor dynamics that favor men in higher-paid sectors and to structural biases in the labor market (Rodríguez *et al.,* 2021). The variables linked to the Human Capital theory follow the trend described in the literature for this type of estimation. Returns to potential work experience are significant at the 1% level in most cases, indicating that labor incomes tend to follow an upward trajectory that gradually slows down over the course of most occupational lifespans (Gómez & Rojas, 2015). Moreover, education coefficients reflect the returns associated with each additional year of education, highlighting the importance of academic training in income determination (Gaspar, 2021; Becker *et al.,* 1990).

To conclude, data from the year 2022 provided by DANE were used to delimit the analysis of education returns in the metropolitan areas of the Colombian State. This choice is based on the observation that three departments contribute significantly, representing 60% of the Gross Domestic Product (CEPAL, 2019). It is also noteworthy that data from the year 2020 were not used due to the presence of the pandemic, as substantial errors were identified that could distort the results (Martínez *et al.,* 2020). It is important to note that the estimation results, both for the female and male subsamples. These tables focus on Bogotá, which serves as the base within the 13 metropolitan areas of Colombia and represents the highest contributor to the GDP.

The results obtained for both the male and female subsamples reflect consistency with the specialized literature on human capital (UNICEF, 2020) Firstly, the data indicate the existence of a gender gap. Although women, on average, exhibit superior both soft and hard skills and have a lower school dropout rate, their educational outcomes, with similar job characteristics, are inferior to those of men (DANE,2020). Secondly, it is observed that the higher returns to education in metropolitan areas, compared to Bogotá, the capital, align with territories that have higher business activity (López *et al.,* 2025; Rodríguez *et al.,* 2021).

In particular, the metropolitan areas of Medellín, Manizales, and Bucaramanga stand out, obtaining the highest educational returns for both the female and male subsamples. These findings coincide with the data from the year 2022, where Bogotá and the departments of Valle and Antioquia contribute 50% to Colombia's GDP, reflecting an amount of 1,465.52 billion Colombian pesos at current prices (DANE, 2022).

The data indicate that, in general, metropolitan areas that are more competitively and, in some cases, geographically distant from Bogotá, show lower returns to education (Ministry of Commerce, Industry, and Tourism, (Romashkina *et al.,* 2020). For example, both in the Caribbean Region with the metropolitan areas of Cartagena, Barranquilla, and Montería, and in the Pacific Region with Pasto, and in the Andean Region with Cúcuta, lower educational returns are evident in both subsamples (Rodríguez, 2024).

Investment in education in metropolitan areas plays a fundamental role in facilitating both social mobility and professional development of individuals (Gómez & Rojas, 2014; Becker, 1964). Those with a solid academic background are better prepared to adapt to changing work environments and seize growth opportunities within their careers. Additionally, the association between education and employability allows professionals to successfully overcome emerging labor challenges (Maldonado, 2021; Hernández *et al.,* 2010).

In a metropolitan environment characterized by competition and constant economic dynamics, education becomes a determining factor for labor productivity and competitiveness (Laverde *et al.,* 2020). Individuals with advanced technical skills and specialized knowledge contribute significantly to the economic development of metropolitan areas (Téllez *et al.,* 2022; Hinojo *et al.,* 2020). The ability

to innovate and adapt to changing demands of the labor market improves significantly with continuous education (Rincón & Gómez, 2023).

The influence of education in metropolitan areas goes beyond purely economic aspects, extending to the realm of sustainable development. Educated professionals are more inclined to participate in civic initiatives, promote responsible business practices, and advocate for sustainable development (Vera & Blanco, 2019; Angulo, 2017). The intrinsic connection between education and social responsibility strengthens the foundation for sustainable and equitable growth in these metropolitan areas (Álvarez *et al.*, 2018; Ibagón & Gómez, 2018).

Conclusions

The data suggests the presence of a gender gap in metropolitan areas, where the highest returns to education are observed, firstly in Bogotá, followed by Medellín and Manizales in second and third place, respectively, for both the female and male subsamples. Returns to education in the metropolitan areas of Colombia are evident across various dimensions, ranging from economic to social aspects. Investment in education emerges as a key catalyst for individual and collective progress in these dynamic environments. To fully harness these returns and ensure inclusive development, it is essential to continue strengthening education policies that promote equity and quality in the country's metropolitan areas.

It is crucial to note that returns to education in Colombia can be significant and vary depending on the educational level and employment sector. However, it is important to recognize that these returns may also be influenced by diverse factors, such as the individual's socioeconomic level and government policies regarding education and employment. In this regard, the continuous improvement of these policies emerges as an essential element to maximize the benefits of educational investment in the country.

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Child-Focused Psychoeducational Resources for Supporting Mental Health in COPMI Families

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This text arises within the theoretical framework of "My dad hears voices: A psychoeducational tool for the awareness of schizophrenia" of Universidad Panamericana

Introduction

The term COPMI (Children of Parents with a Mental Illness) refers to children whose parents or caregivers live with a severe mental disorder. This concept gained prominence through the work of Maybery et al. (2005), who conducted a mixed-methods study involving both psychiatrically diagnosed parents and their children. Their pioneering research brought visibility to this group and highlighted the increased vulnerability children face when growing up in families affected by mental illness. Compared to children from families without such challenges, COPMI are at greater risk for psychological, physical, and social difficulties, often living in environments marked by stress, instability, and emotional strain.

Several key concepts are associated with COPMI, notably equifinality and multifinality. Originally drawn from biology, these terms have been adopted in developmental psychopathology to explain the wide range of possible developmental outcomes. They help illustrate that risk factors—such as parental mental illness—do not lead to a single, predictable path, but rather unfold in complex and non-deterministic ways.

Equifinality refers to the idea that different developmental pathways—shaped by individual, familial, and contextual factors—can lead to the same psychological or behavioral outcome (Cicchetti & Rogosch, 1996). In contrast, multifinality suggests that a single adverse condition, such as having a parent with a mental illness, can lead to a variety of outcomes in children. These outcomes depend on factors like social support, temperament, attachment quality, and early intervention (Cicchetti & Tucker, 1994).

Alongside equifinality and multifinality, the concept of transgenerational transmission offers a valuable framework for understanding the heightened vulnerability of COPMI. As Hosman, van Doesum, and van Santvoort (2009) outline, children of parents with mental illness face a significantly increased risk of developing mental health issues themselves, due to a convergence of interrelated factors across developmental levels. This risk is transmitted through five key pathways: genetic predispositions, prenatal influences (such as maternal stress or substance use), disrupted parent–child interactions, adverse family conditions (e.g., poverty, stigma, conflict), and external social stressors like discrimination or limited access to supportive services. These mechanisms interact cumulatively, shaping a developmental context marked by elevated emotional and psychological risk.

A growing body of empirical evidence confirms the psychological risks faced by children of parents with mental illness. Zheng et al. (2024), using a population cohort of over one million cases in Denmark, demonstrated that children of parents with common affective disorders—such as depression and anxiety—have significantly higher rates of mood disorders, maladaptive behaviors, and stress-related symptoms compared to the general child population. Crucially, these findings held even after controlling for multiple sociodemographic factors. Complementing this large-scale view, Van Loon et

al. (201) conducted a comparative study involving 173 families with a parent diagnosed with mental illness and 190 control families. Their analysis revealed that low levels of parental monitoring—more so than emotional cohesion or affective expressiveness—were strongly associated with an increase in externalizing problems such as aggression, defiance, and disruptive behavior. Together, these findings underscore how both systemic and family-level dynamics contribute to the heightened vulnerability of COPMI.

As discussed so far, the experiences of COPMI children shape their lives in deeply complex ways. These children are not only exposed to higher levels of risk but are also systematically excluded from most therapeutic interventions. This highlights the urgent need to design and implement targeted strategies that acknowledge their role within the family system, provide accessible psychoeducational tools, and promote their long-term emotional well-being. In this context, psychoeducation stands out as a key pathway for empowering COPMI, serving as a supportive resource capable of addressing their specific needs and fostering resilience.

Intervention strategies for COPMI must account for the unique complexities of their lived experience. As Gladstone et al. (2006) argue, these children are not passive recipients of their environment but active agents who interpret their family situation through personal narratives, social dynamics, and their role within the household. Limited access to clear information about a parent's condition, along with diverse coping strategies—from denial to over-responsibility—shapes their understanding and well-being. Social networks may offer support but also contribute to stigma and isolation. Effective psychoeducational interventions must therefore go beyond explaining diagnoses; they must address how parental mental illness affects daily life—disrupted routines, unpredictable behavior, family tension, academic struggles, and social withdrawal. They should also respond to the emotional confusion, unanswered questions, and fragmented narratives that often characterize these children's realities (Gladstone et al., 2011).

Fortunately, the interest that has arisen in COPMI has generated a series of studies that address therapeutic proposals that focus on this population. Tapias et al. (2021) identified 16 psychological programs for COPMI, 87.5% of which included psychoeducation—primarily in group or multifamily formats. These interventions often featured play, storytelling, emotional expression, affect regulation, and peer interaction as core strategies. Similarly, Reupert et al. (2013) conducted a systematic review of 23 programs designed specifically for children of parents with mental illness—excluding those focused on substance use or children with prior psychiatric diagnoses. Most included psychoeducational modules, and the authors highlighted bibliotherapy as a promising tool.

Bibliotherapy is a therapeutic tool often used in psychoeducational contexts to support children facing various forms of vulnerability. It involves using books featuring characters and situations that mirror the child's own experiences, helping them normalize their feelings, build empathy, develop coping strategies, and reframe their reality (Jack & Ronan, 2008; Heath et al., 2005). As Tussing and Valentine (2001) suggest, children's literature, when combined with professional guidance, can offer a safe space for understanding family challenges without guilt or stigma. Bibliotherapy has shown positive outcomes in children exposed to complex family dynamics such as divorce, abuse, or parental illness (Lenzi et al., 2025). Its accessibility and adaptability also make it a viable option in low-resource settings or where specialized psychological care is limited.

In this context, the present study aimed to conduct a systematic review of psychoeducational interventions based on bibliotherapy for children of parents with mental illness (COPMI). Given the specific challenges this population faces, it is essential to explore interventions tailored to their real-life needs. Bibliotherapy, which merges the transformative power of storytelling with the accessibility of written materials, emerges as a promising strategy to support emotional development, enhance coping, and foster understanding of family dynamics. This review seeks to map existing initiatives, examine their core components, and assess the potential of bibliotherapy as a child-centered,

psychoeducational tool for promoting the well-being of COPMI.

To better understand the current landscape of available resources, a structured exploration of the literature was conducted, focusing on materials that merge narrative formats—such as storybooks and children's literature—with psychoeducational objectives tailored to the needs of COPMI. The search process was guided by four main criteria: the type of resource (e.g., "story," "children's book," "storytelling," "bibliotherapy"), the purpose (ensuring psychoeducational intent), the target population (children of parents with mental illness), and the central theme (mental health and family dynamics). These keyword combinations were systematically entered into multiple academic databases, including PubMed, ScienceDirect, Scopus, JSTOR, EBSCO, and Taylor & Francis, prioritizing results in English for broader reach.

This mapping process was careful to include both theoretical and empirical studies published in English or Spanish that addressed the lived experiences of children or adolescents whose parents struggle with mental health conditions. Special attention was given to works exploring the kind of knowledge and emotional tools these children need to navigate their family environment. Only sources directly or indirectly aligned with the core aim of identifying child-centered, narrative-based psychoeducational tools were retained for analysis. The systematic review initially yielded 1,275 articles. After removing duplicates and excluding studies that did not meet the inclusion criteria based on title and abstract screening, a total of 12 studies were selected for analysis.

The final selection comprised twelve studies published between 1985 and 2024, including four empirical investigations and eight theoretical contributions. Most of the works focused broadly on parental mental illness rather than specific psychiatric diagnoses, and the majority targeted children or adolescents as the primary population of interest. Early studies, such as Sargent (1985), Manning (1987), and Henderson (1994), offered foundational theoretical discussions and emphasized the potential of literary materials to facilitate conversations about mental illness within families. Similarly, more recent reviews—such as those by Reupert et al. (2013), Cudjoe and Chiu (2020), and Puchol-Martínez et al. (2023)—synthesized existing programs and conceptual frameworks without presenting or analyzing concrete psychoeducational tools.

Only a few empirical studies directly examined child-centered interventions. Grove et al. (2017) and Kinzenbach et al. (2024) explored children's knowledge needs and mental health literacy, highlighting significant gaps in understanding and communication within families affected by mental illness. Grové et al. (2015) evaluated a psychoeducational group intervention for adolescents, while Vetri et al. (2022) assessed the acceptability and usefulness of a bibliotherapy resource—one of the few studies that explicitly developed a narrative-based tool. Notably, access to the materials described in these empirical works was often limited, as the bibliotherapy resource tested by Vetri et al. was not publicly available.

Across the corpus, only a handful of studies specified the exact materials used. Tussing and Valentine (2001) provided one of the most concrete bibliotherapy proposals, compiling literary works addressing conditions such as PTSD, depression, and schizophrenia. Sargent (1985) and Manning (1987) also referenced storybooks and literary texts that could be used in supportive or educational contexts, offering partially accessible examples of child-appropriate resources. In contrast, many of the more recent publications—despite acknowledging the value of narrative tools—did not include or describe reproducible materials, underscoring a persistent gap between conceptual recommendations and practical, child-centered psychoeducational resources. With these patterns in mind, the studies were subsequently examined through a set of thematic clusters that help illuminate the different ways narrative resources are used with COPMI.

Therapeutic Modalities

In many of the studies reviewed, no formal therapeutic model was explicitly stated to support the use of narrative tools or books. Most interventions were framed within a general psychoeducational approach, aiming to provide children with appropriate information, promote adaptive coping, and reduce the stigma associated with parental mental illness. For instance, Reupert et al. (2013) note that although numerous programs have been developed for children of parents with mental illness, many are not grounded in a specific therapeutic orientation. Instead, they often combine informational, narrative, and participatory elements. Within this context, bibliotherapy emerges as a particularly valuable tool, allowing children to symbolically process difficult experiences through literary characters. This facilitates emotional expression, identification, and reflection without requiring direct confrontation of their circumstances.

However, some interventions do incorporate a clear therapeutic framework. Vetri et al. (2022), for example, developed and implemented a bibliotherapy resource grounded in interpersonal psychotherapy (IPT) principles, aiming to help children understand how their parent's mental illness affects their relationships and emotions. Similarly, studies such as those by Sargent (1985) and Tussing & Valentine (2001) propose the use of children's literature as an indirect therapeutic strategy. While these do not align with a specific theoretical model, they emphasize the importance of relatable characters and direct engagement with themes related to parental mental health.

Levels of Intervention

Most of the reviewed interventions fall within the primary prevention level, focusing on providing information, reducing stigma, and strengthening coping resources before clinical symptoms emerge. For instance, Vetri et al. (2022) developed a preventive bibliotherapy program for COPMI children without psychiatric diagnoses, grounded in interpersonal psychotherapy. Similarly, the group-based intervention by Grové et al. (2015), implemented in school settings, aims to enhance knowledge and emotional understanding from a preventative perspective.

Other approaches, such as those compiled by Reupert et al. (2013) or the work of Tussing and Valentine (2001), can be classified as secondary prevention, targeting children showing early signs of emotional risk, though not yet meeting diagnostic criteria. To a lesser extent, texts like Sargent (1985) suggest the potential use of bibliotherapy as a support tool in therapeutic contexts, aligning more with tertiary prevention. Overall, the materials reviewed demonstrate a flexible applicability depending on the level of clinical need.

Access to Resources

Most of the studies reviewed refer to literary books as the primary tool for psychoeducational support for COPMI, though with varying degrees of structure and purpose. However, many do not specify the exact materials used, nor do they provide access to them, limiting the replicability and practical application of their interventions. For example, while Reupert et al. (2013) identify multiple intervention programs, they do not detail the content or format of the materials involved. The same limitation applies to theoretical reviews such as those by Cudjoe and Chiu (2020) and Puchol-Martínez et al. (2023), which offer valuable conceptual frameworks but do not reference specific resources.

In contrast, some studies do provide clear descriptions of the intervention formats, allowing the identification of storybooks, illustrated materials, or texts with guided activities. Notably, the bibliotherapy proposed by Vetri et al. (2022) includes a structured storybook, although it is not yet publicly accessible. Similarly, works by Sargent (1985) and Manning (1987) highlight the use of literary books or therapeutic stories to foster dialogue and emotional understanding, with some of these titles being available for use. Along the same lines, Tussing and Valentine (2001) compiled a list of literary works addressing topics such as depression, schizophrenia, and post-traumatic stress, offering practical

suggestions for their clinical application.

Disorders Addressed

Most of the reviewed studies do not focus on a specific psychiatric diagnosis but instead refer broadly to "mental illness" or "serious mental disorder" in general, as seen in the work of Grove et al. (2015), Puchol-Martínez et al. (2023), Henderson (1994), and Reupert et al. (2013). This broad diagnostic framing allows for greater applicability of the materials across diverse family contexts, but it may also overlook the clinical and psychosocial nuances of specific conditions.

Nevertheless, some studies do address particular disorders. For instance, Tussing and Valentine (2001) include resources tailored to themes related to schizophrenia, major depressive disorder, and post-traumatic stress disorder (PTSD), while Henderson (1994) focuses on schizophrenia and bipolar disorder. Additionally, Thompson Manning's (1987) work stands out for its specific focus on alcohol use disorder, making it a notable exception within the corpus analyzed.

Modes of Implementation

The studies reviewed reveal a wide range of approaches to implementing bibliotherapy-based psychoeducational strategies. In some cases, such as Vetri et al. (2022), the intervention follows a structured format, with guided sessions led by mental health professionals who support children in reading and reflecting on the book's content—allowing for a deeper and safer engagement with sensitive topics. Similarly, Grové et al. (2015) describe a group-based intervention for adolescents, facilitated by therapists, which encourages emotional understanding and peer discussion through specialized materials.

In contrast, studies such as those by Sargent (1985) and Manning (1987) advocate for a more flexible use of books, suggesting that parents, teachers, or caregivers can employ them as complementary tools to initiate difficult conversations about parental mental illness—without necessarily involving professional guidance. This spectrum reflects a tension between bibliotherapy as an accessible resource and its potential as a formal therapeutic tool. While some authors, like Tussing and Valentine (2001), recommend its use in clinical settings under professional supervision, others highlight its value in everyday environments such as homes or schools, where specialized training may not be required.

Conclusions

The analysis highlights a concerning lack of well-structured, evidence-based psychoeducational interventions specifically designed for children living with parents who experience mental illness. While several studies acknowledge the value of narrative and literary materials as supportive tools, most do not build upon a clearly defined therapeutic framework or apply rigorous methodological guidelines to ensure systematic implementation. Bibliotherapy is often approached from a merely instrumental perspective, where books are used as complementary resources without fully integrating their potential within a formal clinical model.

This issue is compounded by limited access to the materials reviewed—many are not publicly available or lack clear mechanisms for distribution. Moreover, none of the resources included culturally or linguistically adapted versions for Spanish-speaking populations, exposing a significant gap in relevance and equity in mental health care. This omission is particularly alarming in contexts where access to specialized services is already scarce.

These findings point to an urgent need to develop psychoeducational tools that are accessible, culturally responsive, and grounded in robust theoretical models—tools that take into account the emotional, cognitive, and social specificities of COPMI. Rather than focusing solely on information transmission, these materials should foster emotional validation, understanding, and meaning-making,

contributing to resilience-building and supporting the well-being of children facing family adversity.

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The indigenous people of San Francisco Tenopalco

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Introduction

The city is a living entity in constant change. Generally, these changes are imperceptible, since, if it is considered as a complex system, one could say that there is stability in the established order. However, there are events that can generate alterations that lead to more profound changes and accelerate its transformation, both in the physical and spatial aspects as well as in the way of living. These transformations affect in different ways: primarily communities with deeply rooted traditions and customs, as is the case of the indigenous peoples of Mexico, who have been settled since pre-Hispanic times. Unlike the indigenous peoples who still survive, in the indigenous peoples' communities, the population is mixed, and their customs and traditions speak of a syncretism between two great cultures: the Indigenous and the Spanish. These people generally have a rich cultural heritage, both tangible and intangible, which is at risk of being lost in the face of the new dynamics of life. Moreover, many of these transformations derive from different interests, whether foreign or from the population itself in search of progress. Unfortunately, they do not always lead to the much-desired progress, but on the contrary, to damaging the natural and urban environment.

This research is part of a larger study that has studied various towns in the Valley of Mexico, such as Santo Tomás and San Miguel Ajusco, Santa Martha Acatitla, Magdalena Mixiuca, and others. These towns, which were absorbed into Mexico City, share common characteristics, but also have unique characteristics. In this case, the town of San Francisco Tenopalco was analyzed. The town is located on the outskirts of the metropolitan area that has recently been affected by the pressure of urban sprawl and the construction of the new Felipe Ángeles Airport.

From this situation arises the idea of analyzing, from a complex perspective, the impacts derived from these transformations but also those cultural forms that have endured over time and that need to be revalued.

In this case, the hypothesis we propose is that by studying the transformations that have taken place throughout the history of any indigenous town, taking into account the revaluation and protection of their legacy, we will be able to understand their process of incorporation into the urban sprawl, as well as the conservation of their tangible and intangible heritage that survives through time.

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The objective of this research is to explain how urban transformations stemming from a progressive vision affect San Francisco Tenopalco, whose population has a long-standing cultural heritage. The specific objectives include characterizing the urban transformations that have impacted the study area and identifying relevant tangible and intangible heritage elements that should be revalued and preserved.

Case study: San Francisco Tenopalco, an indigenous town in the Valley of Mexico

The original name of San Francisco Tenopalco is Tenopaltitlan, which means "stone cactus". It is one of the three towns located in the current municipality of Melchor Ocampo, State of Mexico. The town dates back to 1297. Its history is linked to the arrival of Chichimeca and Acolhua groups in the 12th century, who settled in the region and developed an advanced culture with a high degree of civilization and classical Nahuatl language. The alliance between Xolotl, the Chichimeca leader, and the Acolhua, as well as the founding of the city of Tetzcoco, were key events in this era. Later, the arrival of the Spanish brought about a profound transformation, not only military but spiritual. The mendicant orders arrived there, first the Dominicans and later the Franciscans, which led to the town's name being changed to San Francisco Tenopalco, in honor of Saint Francis of Assisi, thus reflecting the cultural fusion and transformation experienced by the region's indigenous peoples.

With a latitude of 19° 42' 45" north, a longitude of -99° 6' 58" west, and an altitude of 2,254 meters above sea level, San Francisco Tenopalco is located partly in a hilly area and partly on a plain that made agriculture possible. It is also close to routes that connect important Mesoamerican centers, which favored its establishment.

Over time, it has remained a rural agrarian settlement, however, in the 1990s, with the PROCEDE program, the ejido of San Francisco Tenopalco was regularized to allow its urbanization, which facilitated the titling of land and promoted its expansion as a human settlement since its land use changed, consolidating the town as an urban rather than rural development zone.

Due to its location between the municipalities of Tultepec, Cuautitlán, Zumpango, and Nextlalpan, the pressure for urban development has increased due to its proximity to these already urbanized municipalities and the construction of the new Felipe Ángeles Airport.

Urban and sociodemographic characteristics

As mentioned, San Francisco Tenopalco is a community in transition that blends rural and urban elements. The original town has 55 blocks. Six streets have paved streets, 30 have partial paved streets, and 19 have no paved streets at all. Of the 55 blocks, only three have ramps, resulting in a lack of accessibility for people with disabilities.

Regarding infrastructure, there is street lighting only on the main streets, and not all blocks have sewage systems or household water connections. The latter service is not regulated by the municipal government, but rather by the ejidatarios (communal landowners), who have their own water wells and provide this service to both the original residents and the expanding areas.

Regarding land use, in the original area, a mix of agricultural and residential uses is common, whereas in the new growth areas, residential use is informal and often irregular. That is, the subdivision of properties is carried out by the seller without any intervention from the municipality. Therefore, a significant number of these residents only have contracts and lack deeds. The streets in these growth areas are not registered with the municipality, so they also lack services such as garbage collection. This means that residents dispose of waste in various ways, either by creating illegal dumps or burning them.

In these areas, there are more roads than streets, often crossing private property. When these properties are sold, they are blocked, creating unplanned and labyrinthine layouts. While the town boundaries that appear on applications like maps encompass what the town originally was, the actual boundaries have expanded unevenly, making them confusing, even for the Melchor Ocampo administration.

Regarding housing, in the original town, homes are built with durable materials, without a defined architectural typology, and self-construction generally predominates. The plots are large, and what it could be called garden houses are typically the norm. In contrast, in the expanding areas, mainly in the hills, there are stark contrasts. Because this is an area with lower land values and affordable to the most vulnerable population, construction is generally done with perishable materials at first, and as people became able to build, they replace them with materials like concrete blocks, even if they lack of wall claddings, in other words, what it could be called the gray city. But there are also constructions that are generally carried out by buyers with greater purchasing power, who prefer to buy a larger lot in this area and build instead of buying a small apartment in the city, often less than 40 square meters.

Regarding its demographic characteristics, according to the 2020 INEGI census, it has a total population of 5,086 inhabitants, of which 50.6% are women and 49.4% are men. The population is composed primarily of families of rural origin, although since the beginning of this century, migration from nearby urban areas has increased, which has influenced its social and economic dynamics. The population has a young structure, with a considerable percentage of people of working age, mostly adults between 30 and 59 years old. (INEGI, 2020)

Regarding its sociocultural characteristics, the average level of education of the population is 9.05, indicating that most residents have only completed basic secondary education.

The social structure of San Francisco Tenopalco is divided. On one side are the town's ejidatarios (communal landowners), who have their own organization where they appoint a main delegate. They also have a Citizen Participation Council (COPACI), which acts as leaders or spokespersons for the town. These representatives are democratically elected only by the original inhabitants.

The election of COPACI delegates and members takes place through fifteen-day campaigns within the area of the town's residents and native inhabitants. They are then elected to manage and participate in the implementation of municipal programs for the improvement of the town, especially regarding services and public works.

In the expansion zone, given the illegality of many of the properties, volunteer leaders have emerged who have been working with the municipality to process some improvements for these areas, but they do not participate in the local organization.

Tradition and heritage of San Francisco Tenopalco

The heart of San Francisco Tenopalco is the main plaza, where the Parish of San Francisco de Asís is located. This church dates back to the early 17th century, according to residents. It still preserves its posa chapels, architectural elements used in the monastery complexes of New Spain. Its façade is sober, made of tezontle stone. It has a single tower, whose construction appears to have been later than the rest of the church. This is the town's most important festival, held around its patron saint, Saint Francis of Assisi, on October 4th. The celebration begins at midnight on October 3rd, when the town welcomes the festivities with fireworks.

During the day, various activities take place, primarily the tour of San Francisco de Asís through the town, starting from Corregidora Street, which connects with the town of Visitación, to Totoltepec Boulevard, which marks the southern border of the municipality of Melchor Ocampo and the border with the municipality of Tultepec, and finally arriving back at Plaza Morelos, where the temple is located. For part of the procession, the Saint is accompanied by pyrotechnic bulls donated to the festival by indigenous families, along with bands. The streets where the Saint passes are decorated with confetti. The Church of San Francisco de Asís, where the procession begins and ends, is adorned with various flower arches and sawdust carpets with pre-Hispanic themes, reflecting the religious syncretism.

It's important to keep in mind that these festivals are a representation of local culture and are not only a means of commemorating historical or religious events, but also a vital way of preserving their identity as a people through dance, music, cuisine, and rituals. These festivals transmit values and traditions to new generations, ensuring that their cultural legacy endures over time. The planning of this festival begins almost a year in advance. A *steward is chosen* from among the town's native families, who will organize it along with two or three other chosen families and the parish priest on duty. This is done through a democratic vote of the assembly, that is, of the native residents. During the four Sundays prior to the festival, the stewardesses and those involved with the event go from house to house to solicit contributions for the celebration. Among other activities that take place during the day are the presentation of rituals and typical dances representative of the area. Similarly, during the night of the fourth, various musical and dance events are held for the enjoyment of the entire town. While this isn't the only festival, it is the most important, showcasing the culture and identity of this place. However, residents of the growing areas, who are generally not native to the town, don't seem to participate in the same way. Even if they live nearby, they don't always attend the festivities, much less participate in their organization.

Impacts resulting from urban transformations

The study sought to characterize urban transformations that could affect tangible and intangible heritage, as well as the environment.

One of the main aspects identified regarding the transformation of this town from a rural community to an increasingly urban one is the existence of problems of alienation and social fragmentation between the original inhabitants and the new residents. While these problems are tolerated, as the original inhabitants of Tenopalco or Tultepec themselves have sold part of their land to the new residents, they do not include them in the town's activities. Furthermore, the new residents, belonging to a less protected socioeconomic sector, take jobs related to the fireworks industry characteristic of Tultepec (a neighboring municipality) in their own homes, which has led to accidents due to the use of gunpowder. Regarding the impact on heritage, urban expansion has led to the disappearance of spaces that had historically been used for social and cultural activities, affecting the collective identity of the inhabitants. Such is the case with the lands where the crucifixion was held during Holy Week. These lands were characterized by an abundance of pirule trees. Currently, some human settlements are present, either through invasion or purchase and sale. The new inhabitants cut down the trees or carry out severe pruning, which has damaged them, causing desertification and erosion in the area. However, the activity that took place there remained in the collective memory, and the people have given this settlement the (unofficial) name Colonia El Calvario. The accelerated change in the urban structure of San Francisco Tenopalco, coupled with the construction of the new airport, could provoke what has happened in the indigenous communities of Mexico City: that is, these communities have been absorbed by the urban sprawl, causing an increase in the land value and its gentrification. It has also led to the alteration of traditional customs and festivals.

This has not yet happened in Tenopalco, but land sales prices have already been rising, going from less than 500 pesos per square meter to 1,500 and even 3,000 pesos in less than ten years, and this is in areas that still lack infrastructure. The study area lacks adequate planning; there is no urban development program for the municipality, which encourages uncontrolled urban sprawl.

One of the most significant impacts is the loss of natural heritage. Urban expansion increasingly reduces the amount of available green space, encourages waste accumulation, and soil and air pollution in areas lacking infrastructure, further deteriorating the landscape. Furthermore, new construction in areas prone to landslides increases vulnerability to natural disasters.

If San Francisco Tenopalco continues the same growth pattern that Mexico City saw over the last century, it will lead to the same deficiencies and impacts on the identity of its inhabitants, social

fragmentation, and risks from climate change. Therefore, it is important to generate new visions that meet both the needs and right to housing of the vulnerable population and prevent the impacts generated by unplanned settlements.

Conclusions

Indigenous peoples, and in this case San Francisco Tenopalco, maintain ancestral practices that strengthen their identity, such as community organization through assemblies and the defense of their territory. In this case, heritage becomes an instrument to demonstrate their preexistence and legitimacy as a people tied to their territory, as well as to strengthen their cultural and spiritual practices in the face of external transformation. Considering the principles of complex thought, it is clear that there is a dialogical relationship between the original population of San Francisco Tenopalco and its expansion zones. Although they can be considered antagonistic and mutually exclusive in nature, they are inseparable in the reality under study, as both affect each other. Regarding the principle of recursion, it can be interpreted that as uncontrolled expansion continues, the original population will be more affected, and social fragmentation will become increasingly evident, which can lead to friction among its inhabitants.

From the holographic principle, it can be said that studying San Francisco Tenopalco, as part of the municipality of Melchor Ocampo, allows us to understand what is happening in other towns within this municipality and surrounding municipalities. It is important to mention that San Francisco Tenopalco has particularities that can be considered within the principle of emergence. Furthermore, from the principle of self-eco-organization, it can be said that the dialogue between urban processes within and outside the town—that is, its relationship with the environment—accounts for the origin of the new expansion zones derived from its relative proximity to the suburban train and the new AIFA airport. Finally, regarding the principle of fuzziness, which establishes that not all statements or concepts can be defined in black and white, urban processes are not necessarily good or bad. This has been seen in the study of different communities, as the views of native inhabitants and residents can be conflicting, and what seems good to some may seem bad to others, and both may be right. There are still unknowns to be studied for future research, such as the evident topophilia (Bachelard,1957) of the original inhabitants and the territorialization processes of the new residents. This cannot be done in a simplistic and reductionist manner; it must be done from a perspective of complexity and transdisciplinarity (Basarab, 1996), since both processes involve complex and dynamic relationships between people and their environment.

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Universal Declaration of Duties and Mental Health

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This work by the To Give Welfare Foundation "Dasbien" stems from the spirit of creating and sharing a tool for coexistence that promotes the common good.

Introduction

Social and political organization has historically been based on the notion of individual rights, considered inalienable and fundamental for human development (United Nations, 1948). However, the "Universal Declaration of Duties" (Figueroa, 2025) presents an alternative vision in which rights are redefined as duties, transforming the approach to individual and collective responsibilities. This paradigm shift suggests that the common good is not simply guaranteed by granting rights, but through the active fulfillment of duties by individuals and organizations. While innovative, this position contrasts with liberal theories such as Rawls's (1971) justice as fairness, which prioritize individual rights as safeguards against potential state overreach, and Berlin's (1969) distinction between positive and negative liberty, which warns that expanding duties could unintentionally restrict personal freedom.

Problem Statement

The central question of this research is how can the redefinition of rights as duties contribute to the common good? Traditionally, the concept of rights has been interpreted as a set of legal guarantees that protect individuals from potential abuses of power (Rawls, 1971). However, this perspective can lead to a culture of passivity, where individuals focus more on demanding their rights than on assuming social responsibilities. The "Universal Declaration of Duties" seeks to reverse this trend by emphasizing the obligation of every human being to actively contribute to their own and collective well-being (Figueroa, 2025).

From a philosophical standpoint, the idea of duties is not new. Kant (1785) argued that morality should be based on categorical imperatives, which imply acting according to universal principles of obligation. Similarly, Aristotle (350 BCE) suggested in his Nicomachean Ethics that happiness and virtue are achieved through responsible action and fulfilling duties toward society. Based on this concept, the 'Universal Declaration of Duties' suggests that each person not only has the responsibility to pursue their own happiness but also to proactively engage with society and the natural world (Figueroa, 2025). This redefinition of rights as duties can impact various areas of human life, including politics, education, and economics. In the political sphere, it could encourage more participatory citizenship engaged with democratic governance (Putnam, 1993). In education, this would involve revising academic programs to teach children and young people about the importance of social responsibility and community service (Noddings, 1984). In economics, companies would adopt more sustainable and ethical production models, promoting collective well-being instead of individualistic profit (Freeman, 1984) and distribution.

The fulfillment of duties is an essential pillar for building equitable and sustainable societies. Redefining rights as duties promotes a culture of active responsibility, where each individual plays a

role in promoting collective well-being (Figueroa, 2025). From a philosophical and ethical perspective, duties have been considered fundamental in social organization, from Aristotelian thought to modern theories of the common good (Aristotle, 350 BCE; Rawls, 1971).

In the current context, characterized by environmental crises, economic inequalities, and social conflicts, a duty-based approach offers an alternative framework for addressing these challenges. The idea that "organizations such as the State, governments, and companies have the ultimate goal of promoting duties" (Figueroa, 2025, p. 4) highlights the need to integrate this vision into public policies and economic models. Moreover, implementing a duty-based ethic in education and governance can strengthen community bonds and promote values of solidarity and cooperation (Putnam, 1993). This approach also has important implications for mental health, as empirical studies indicate that active social participation, a sense of purpose, and prosocial behavior are associated with lower rates of depression and anxiety, and with higher levels of subjective well-being (Keyes, 2007; Seligman, 2011). By fostering collective responsibility, the Universal Declaration of Duties can contribute to preventive mental health strategies at both individual and community levels. Therefore, this research aims to highlight the importance of duties as a key foundation for ensuring harmonious, sustainable coexistence and improved psychological well-being.

Origin and Philosophical Foundations of the Universal Declaration of Duties

The concept of duty has been a cornerstone of moral philosophy throughout history. Aristotle (350 BCE), in his Nicomachean Ethics, argued that virtue and happiness depend on responsible action and the fulfillment of duties toward the community. For Aristotle, individual well-being was intrinsically linked to the common good, and the fulfillment of duties was essential for social harmony. In his teleological view of ethics, human beings can only achieve their highest purpose (eudaimonia) through a virtuous life that involves fulfilling responsibilities toward the polis. Later, Immanuel Kant (1785), in his Groundwork of the Metaphysics of Morals, formulated the Categorical Imperative, which asserts that individuals must act according to universal principles applicable to all of humanity. According to Kant, duties do not depend on external consequences but rather on rationality and the moral obligation inherent in every individual. In this sense, Kantian ethics reinforces the idea that duty is not an arbitrary choice but a command of pure reason that must be fulfilled regardless of the outcome.

The ethics of care, proposed by Gilligan (1982), introduced a relational perspective on moral duty. Unlike justice-based theories centered on rights, care ethics emphasizes the importance of human relationships and the responsibility of individuals in promoting the well-being of others. This perspective complements the Universal Declaration of Duties by highlighting the interdependence of human beings and the need to act in accordance with the common good. According to Gilligan, duty should not be conceived solely in terms of abstract rules but as an active commitment to others within a framework of empathy and solidarity. Similarly, the theory of collective well-being has been developed by authors such as Sen (1999) and Nussbaum (2011), who argue that social equity can only be achieved when institutions and individuals assume concrete duties toward the most vulnerable. According to Nussbaum, a society's capacity to ensure well-being depends on its structure of duties and the willingness of individuals to prioritize the common good over personal interest.

The connection between duty and well-being has also been addressed in sustainability and development studies. For example, Ostrom (1990) demonstrated that communities that assume collective duties toward natural resources are more successful in environmental preservation than those relying solely on state regulations or individual property rights. This finding supports the idea that taking on responsibilities not only affects personal ethics, but also transforms social and economic structures for the benefit of the planet. Within this context, the Universal Declaration of Duties is framed within a philosophical tradition that seeks to balance individual development with collective well-

being. By redefining rights as duties, this declaration proposes an ethical and social model in which each person actively assumes their role in building a more equitable and sustainable society. Thus, it not only establishes moral obligations but also promotes a culture of shared responsibility that strengthens social cohesion and human development.

Relationship with the Dasbien Theory

The Dasbien Theory, proposed by psychologist Andy Figueroa Cárdenas in 2010, offers a comprehensive perspective on love, defining it as a conscious action oriented toward the well-being of other beings. This theory is broken down into three fundamental dimensions, known as the "Three Dimensions of Love": Receiving love from other beings: This first dimension focuses on the individual's inherent need to be loved during crucial moments in life, such as childhood, old age, periods of illness, and stages of learning. According to Figueroa Cárdenas, this dimension is essential for identity formation and healthy emotional development. Giving love to oneself: The second dimension emphasizes the importance of self-care and personal growth. From this perspective, self-love is a fundamental duty, as personal well-being forms the foundation for offering genuine love to others. Giving love to other beings: The third dimension involves the act of providing well-being to others, including one's family, community, animals, and the natural environment. This dimension highlights the individual's social responsibility in building a more equitable and sustainable world.

The Dasbien Theory establishes an intrinsic connection between love and duty in human existence. Each of the "Three Dimensions of Love" entails responsibilities that translate into duties toward oneself, toward others, and toward nature. This perspective suggests that love is not merely a passive feeling but an active force that drives individuals to fulfill their ethical and moral obligations. In the first dimension, receiving love from other beings, it is acknowledged that in vulnerable stages of life – such as childhood or illness – people depend on the care and affection of others. This recognition generates a reciprocal duty: having received love and care, the individual acquires the responsibility of offering the same to those in need in the future. The second dimension, giving love to oneself, underscores the duty of self-compassion and self-care. Loving oneself is not an act of selfishness but a responsibility that enables individuals to maintain physical, mental, and emotional well-being. This self-care is fundamental to fulfilling other duties toward society and the environment. The third dimension, giving love to other beings, emphasizes the responsibility to act for the benefit of other living beings and the natural environment. This dimension of love translates into concrete actions that seek the well-being of others and the preservation of the natural world.

The Dasbien Theory proposes that love is an interaction that involves giving something good to the other, based on what is beneficial from the recipient's perspective. This approach highlights the importance of knowing and understanding the needs and desires of others so that acts of love can be truly effective and positive. Furthermore, the theory identifies three stages or components in the act of loving, known as the "Triangle of Loving": Subjectivize: The sender investigates and seeks to understand what is good for the recipient, according to the latter's inner world. Intend: The sender deliberately decides to carry out an action considered beneficial for the recipient. Interact: The sender performs the action directed toward the recipient, seeking their well-being and satisfaction.

These components underscore that love is an active and conscious process that requires intention and understanding of the other. By integrating these elements, the Dasbien Theory offers an understanding of love as a practice that goes beyond emotions, focusing on concrete actions that promote the well-being of others and, therefore, the assumption of ethical and moral duties in human life. Additionally, the theory reinforces the idea that love must extend beyond the interpersonal realm to include the relationship with the environment. Ecological responsibility, according to Figueroa Cárdenas, is a form of love expressed through actions that protect the planet and ensure optimal conditions for future generations. In this regard, it aligns with the ethics of responsibility proposed by Hans Jonas (1979), who argues that human beings have a moral duty toward nature, based on their

capacity to affect its balance.

Finally, the Dasbien Theory emphasizes that love is not a static concept but a practice that evolves and adapts to life's circumstances. Loving responsibly involves continuously learning how to improve the way one interacts with others and with the world. Therefore, education in love and duty is an essential element in building more harmonious and sustainable societies. From a mental health perspective, the Three Dimensions of Love proposed by the Dasbien Theory—receiving love, self-love, and giving love—align closely with protective factors identified in positive psychology and community psychology, such as perceived social support, self-efficacy, and altruism (Ryff, 1989; Keyes, 2007). Integrating these dimensions into educational and community programs can strengthen resilience, reduce social isolation, and promote emotional well-being.

Fundamental Principles of Duties

The Universal Declaration of Duties establishes that the purpose and rationale of duties is the pursuit of goodness, well-being, and the common good (Figueroa, 2025). These three core principles structure both individual and collective obligations, guiding human interactions toward a more equitable and harmonious society. According to Figueroa (2020), the concept of duty transcends the notion of moral obligation, becoming an essential element in the construction of a just and sustainable society.

The concept of goodness involves acting in accordance with ethical and moral principles that foster justice, cooperation, and solidarity. From the perspective of the Dasbien Theory, goodness is manifested in actions intended to benefit others, aligning with the notion of active love proposed by Figueroa (2010). This principle demands that individuals recognize their duty to contribute to general well-being without expecting an immediate reward. In Lo Bueno (The Good), Figueroa (2020) emphasizes that goodness should be understood as a voluntary responsibility of each individual to generate a positive impact on society. Well-being, in turn, encompasses not only personal development but also the welfare of the community and the natural environment. In Lo Bueno, Figueroa (2020) highlights that well-being cannot be viewed solely from an individualistic standpoint, but rather as a collective goal achieved through the fulfillment of shared duties. Social interdependence requires that each person assume responsibility for promoting general well-being through concrete actions that foster community growth.

Finally, the common good represents the outcome of coordinated actions by individuals for the benefit of the collective. In Das Bien (Give Good), Figueroa (2010) stresses that the common good arises when individuals adopt a duty-based ethic oriented toward cooperation and mutual respect. Applying this principle across various domains – such as politics, education, and the economy – enables the consolidation of more equitable and harmonious societies. Moreover, the common good is not an abstract concept but an achievable goal through co-responsibility and collective effort. Fulfilling one's duties is essential to ensuring peaceful and equitable coexistence. The Universal Declaration of Duties emphasizes that duties should not be perceived as external impositions but as voluntary commitments that strengthen social cohesion (Figueroa, 2025). While this vision promotes cooperation and reciprocity, it differs from rights-based frameworks such as those proposed by Dworkin (1978) or Nussbaum (2011), which argue that ensuring individual capabilities and freedoms is a prerequisite for collective well-being. From this perspective, an overemphasis on duties without parallel guarantees of rights could risk undermining the very solidarity it seeks to foster. Therefore, translating duties into concrete, everyday actions requires maintaining a balanced interplay between individual liberties and collective responsibilities.

Duties Toward Oneself

Duties toward oneself constitute the foundation of both individual and social development, as they enable each person to cultivate their well-being, strengthen their character, and regulate their emotions to positively contribute to society. According to the Figueroa (2025), self-care and personal development are essential for the fulfillment of collective duties, as a balanced individual who is aware of their responsibilities can positively impact their environment. Self-care is a fundamental duty that each person owes to themselves. In Lo Bueno (The Good) by Figueroa (2020), it is stated that personal well-being is a prerequisite for building a fair and balanced society. This concept includes not only physical health, but also intellectual, emotional, and spiritual development. Personal development is a continuous process that allows individuals to improve their judgment, decision-making abilities, and community impact.

Self-care should not be viewed as a form of indulgence but rather as an ethical and social duty. In Das Bien (Give Good) (Figueroa, 2010), it is emphasized that individual well-being cannot be separated from collective well-being. Therefore, fulfilling this duty involves acquiring knowledge, engaging in constant self-reflection, and developing healthy habits that benefit both the individual and the community. The balance between individual and collective well-being is a key principle in the ethics of duty. The Universal Declaration of Duties states that each person should pursue their own development without harming others, ensuring that their actions contribute to the common good (Figueroa, 2025). This principle is based on the idea that individual development and social progress are interdependent. Balancing personal and collective well-being also involves a commitment to education and lifelong learning. Personal development is an essential tool for shaping responsible citizens who are conscious of their duties. In Das Bien, Figueroa (2010) asserts that knowledge and ethics are inseparable, as only through education can a society be built upon solid values and mutual respect. The regulation of thoughts and emotions is another fundamental aspect of duties toward oneself. According to Figueroa (2025), emotional self-control is essential for peaceful coexistence and responsible decision-making. Emotional management not only contributes to personal well-being but also influences how individuals interact with others and resolve conflicts.

Duties Toward Other Human Beings

Duties toward other human beings constitute a fundamental pillar in the construction of just and equitable societies. The Universal Declaration of Duties highlights the importance of social responsibility and promoting the well-being of the disadvantaged for achieving harmony and collective development (Figueroa, 2025). Social responsibility implies the recognition that each individual is part of an interdependent community, where personal actions affect collective well-being. According to Figueroa (2020), the ethics of duty establish that human beings are obliged to actively contribute to social progress, promoting values such as solidarity, justice, and cooperation. In Lo Bueno, it is highlighted that the construction of sustainable societies depends on citizens' commitment to general welfare rather than personal interests alone. In Das Bien (Figueroa, 2010), it is stated that social responsibility should not be seen as optional, but as a duty inherent to human nature. Participation in community activities, the promotion of solidarity initiatives, and support for those in need are concrete examples of this principle. Moreover, social responsibility includes preserving fundamental values, such as respect and equity, and ensuring that future generations can enjoy a harmonious and just environment. One of the key principles of the Universal Declaration of Duties is the promotion of the well-being of the most vulnerable sectors of society. It holds that human development can only be achieved when dignified living conditions are guaranteed for all individuals, regardless of origin or social status (Figueroa, 2025). This principle aligns with the concept of social justice proposed in Lo Bueno (Figueroa, 2020), where the importance of reducing inequality through the fulfillment of individual and collective duties is emphasized.

Duties Toward the Environment and Other Living Beings

Respect and protection of the environment and other living beings are essential duties in building a sustainable world. The Universal Declaration of Duties underscores the importance of adopting a responsible attitude toward nature, ensuring ecological balance for future generations (Figueroa, 2025). This duty involves not only preventing environmental degradation but also actively promoting ecosystem regeneration and biodiversity conservation. Environmental conservation is not only an ecological necessity but also an ethical principle of respect for life. In Lo Bueno (Figueroa, 2020), it is stated that environmental damage reflects a lack of human responsibility and that ecological degradation affects both current and future communities. The overexploitation of resources, pollution, and biodiversity loss are problems that demand active commitment for their mitigation.

The link between duty and environmental sustainability lies in each person's obligation to reduce their negative impact on the natural world. The Universal Declaration of Duties establishes that every human being has the duty to protect the planet and ensure the rational use of its resources (Figueroa, 2025). This principle implies a shift in collective mindset, promoting responsible lifestyles and public policies geared toward sustainability. Sustainability should not be viewed solely as a governmental responsibility but as a personal commitment. Figueroa (2020) argues that sustainability is a moral duty that must be integrated into daily life. In Lo Bueno, the importance of adopting habits such as responsible consumption, waste reduction, and biodiversity conservation is emphasized as concrete ways to fulfill this duty. Individual actions – such as recycling, reducing plastic use, and supporting ecological products – can generate a significant impact on environmental protection.

Conclusions

This study confirms that the Universal Declaration of Duties (Figueroa, 2025) offers an innovative normative framework that seeks to balance individual autonomy with collective responsibility, articulating principles of reciprocity and solidarity (Rawls, 1971; Nussbaum, 2011). However, the research acknowledges significant limitations. First, the analysis relied mainly on documentary review, without incorporating case studies or empirical data to evaluate the model's effectiveness in diverse contexts. This absence reduces the possibility of assessing the real applicability of the proposed principles, as well as measuring their impact on strengthening social cohesion or environmental sustainability (Jonas, 1979; Putnam, 1993). Second, the transition from a rights-based paradigm to one centered on duties may face cultural and political resistance, especially if safeguards are not established to prevent coercive interpretations (Sandel, 1982; Sen, 1999).

Despite these limitations, the findings suggest several prospective lines of action: 1. Education and civic training: integrate the teaching of duties into school and university curricula, fostering active and responsible citizenship (Noddings, 1984; Nussbaum, 2011), 2. Progressive legal reforms: include principles of duties in legislation, ensuring that their implementation is participatory and does not imply the suppression of rights (Figueroa, 2025), 3. Community participation: create deliberative spaces where citizens collaborate in the design of duty-based policies (Freire, 1970; Putnam, 1993), 4. Economy for the common good: promote productive models that prioritize collective benefit over individual gain (Felber, 2015; Freeman, 1984), 5. Sustainability and ecological ethics: consolidate environmental policies based on intergenerational responsibilities, as proposed by Jonas (1979), to ensure the planet's preservation, 6. Ultimately, the Declaration should not be limited to a normative document but should be consolidated as a cultural and political instrument that, supported by empirical evidence and democratic mechanisms, can drive a structural change in how societies conceive justice, development, and sustainability. Its success will depend on the ability to connect theory and practice, ensuring that the fulfillment of duties translates into concrete actions that strengthen the common good (Figueroa, 2010; 2020; 2025).

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Impact of strategic management in higher education institutions: A systematic review

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Introduction

Currently, strategic management in higher education for decision-making is undergoing significant transformations globally. These transformations are reflected in the studies by (ULLOA-PIMIENTA et al., 2023) (ULLOA-PIMIENTA et al., 2023) (Mohana et al., 2022) . These studies analyze various aspects of strategic management in higher education, highlighting both challenges and opportunities in this field, rapidly adapting to a dynamic and competitive environment that requires timely decisions to ensure sustainability in areas such as brand value, human talent management, and academic and administrative aspects that will ultimately make a difference.

Within this context, the central problem addressed in this systematic review is the need to understand how strategic management can optimize decision-making in higher education institutions. Despite advances in educational management theory and practice, significant gaps remain in the effective application of strategies that improve institutional performance and ensure long-term sustainability. This allows for the generation of multidisciplinary management theories (Fernández et al., 2024), which complement the budget allocation for success in the higher education system (Fernández Mijares et al., 2023).

From a theoretical perspective, strategic management provides a framework for aligning resources, innovating processes, and responding to the demands of the global environment. The theoretical justification is based on evidence that effective strategic management can improve the competitiveness and relevance of institutions (Fumasoli & Lepori, 2011) (Degn, 2015) . In practical terms, this study seeks to identify and evaluate best practices in strategic management that can be adopted and adapted by higher education institutions to overcome current and future challenges (Sawhney et al., 2017) (Mohana et al., 2022) . Meanwhile, universities adopted strategic management ideas to achieve competitiveness (Kola, 2024) , allowing for the integration of sustainable development goals through a set of strategic documents that activate inclusive and equal educational policies (Chenú Orrego & Rolón, 2025) .

In this regard, the main objective of the article is to describe the scientific evidence on the application of strategic management in decision-making within higher education institutions, identifying the most effective strategies and areas that require further research.

Finally, the article is organized as follows: first, the methodology is presented using the PICO framework, search equation, and PRISMA flow diagram, considering relevant inclusion and exclusion criteria that address different approaches and practices in strategic management. Second, key findings from the selected studies are presented, highlighting both similarities and differences in their results. Third, the methodological and theoretical limitations of the reviewed studies are discussed, and recommendations for future research and practice are proposed.

The findings in the review of scientific articles highlight the impact of strategic management practices on decision-making in higher education institutions. Strategic management in higher education is undergoing significant transformations globally, as reflected in studies by Inga et al. (2021) and , which also mention that the focus of education is on academic management based on metrics from other universities worldwide. all with the support of strategically managed digital transformation (Carmo et al., 2025) .

In this regard, efforts have been made to achieve, maintain, and sustain competitive advantages in higher education institutions (Hamadamin & Atan, 2019) and contribute to the development of broader objectives through the integration of course design (Wang, 2025) . This will enable compliance with the Sustainable Development Goals (SDGs) and coordinated work on governance in higher education institutions, with processes and structures that guide decision-making and policy implementation in these institutions (Da Costa Marques, 2025) .

It is important to note that Degn (2015) highlights how new ideas about accountability and transparency are shaping higher education in Denmark, influencing the identity and objectives of managers. This study expands on Henkel's findings on the influence of traditional academic norms, suggesting the need for transnational studies to better understand these dynamics. Similarly, they evaluate digital reputation in students' decisions about digital presence and its better management (Jihad & Younes, 2025) and the ethical value of integrating sustainability principles into strategy and operations in institutions (Rotondo et al., 2025) . For this reason, it is mentioned that, in this digital age, data analysis and the use of technology have become essential in academic management education at the higher level (Correa-Peralta et al., 2025) , with the use of a vector model based on sustainability, designed for adaptive governance and decision-making in higher education, based on systems theory, the science of sustainability, and mathematical logic, including automorphic transformations and fractal reasoning (Flori et al., 2025) .

In the field of information analysis, Nieto et al. (2019) highlight the effectiveness of machine learning in identifying students at risk of not graduating, with the Random Forests algorithm showing an accuracy of 83%. This suggests that the implementation of these technologies can improve decision-making in higher education institutions. In comparison, Ulloa-Pimienta et al. (2023) analyze a university in Mexico, highlighting its strengths and weaknesses in infrastructure and management. Although it faces challenges such as technological backwardness and communication problems, it is recommended that these weaknesses be transformed into opportunities to maintain competitiveness. This is because some higher education institutions still view the implementation of technology as an expense rather than an investment.

However, Fumasoli and Lepori (2011) highlight the importance of strategic coherence for the competitiveness of institutions, especially small ones. Their findings suggest that university strategies should be analyzed empirically to understand their specific characteristics and differences between institutions. On the other hand, Yussif and Mante (2023) emphasize the importance of a clear vision and mission that incorporate the interests of students, highlighting the value of the Field Practice Program and the need for good leadership and effective feedback systems, seeking to align with the strategic objectives of the educational organization by implementing quality assurance (QA) and institutional research (IR) with the purpose of generating data that supports evidence-based decision-making for better strategic management (Kadhila, & Likando, 2020).

However, Hu et al. (2017) provide a perspective on the differentiation of higher education in China, showing how strategic planning varies between prestigious institutions and other less recognized ones. This reflects the diversity of needs and approaches in the formulation of plans and missions. Nevertheless, Allui and Sahni (2016) point to insufficient attention to human resource management practices in Saudi universities, which affects faculty satisfaction and retention. Improving these practices is essential to cope with a rapidly changing environment. Strategic brand management should be considered as a means of differentiating higher education (Lim, et al., 2018).

Consequently, Sawhney et al. (2017) find a strong correlation between strategic management and organizational excellence, recommending that the Indian higher education sector adopt strategic management practices to overcome challenges and achieve global standards. In this regard, Kadoić et al. (2018) present the Simple, Non-valuable, Aligned, and Prioritize (SNAP) method as an efficient alternative to Process Network Analysis (PNA) in strategic decision-making, highlighting its lower complexity and greater efficiency. Its application to specific decision-making problems in higher education will be compared with PNA to identify similarities and differences. The implementation of strategies has the greatest impact on employee performance, followed by environmental analysis, strategy formulation, and evaluation and control. This underscores the need to focus on these factors to improve performance in higher education institutions (Mohana et al., 2022).

According to Sawhney et al. (2017), Calzada (2023), Stukalina, Kenno, S., et al. (2020), Y. (2014), and Mohana et al. (2022) agree that strategic management is crucial for improving organizational performance in higher education institutions. Both studies highlight a strong correlation between strategy implementation and organizational excellence.

It should be noted that traditional academic norms and institutional identity influence university strategic management (Degn, 2015; Santati, et al., 2022; Mourato et al., 2019, and Stensaker et al., 2014). Both studies suggest that these norms can shape strategic decisions and organizational culture in public and private universities. On the other hand, global geopolitical tensions challenge international student mobility, in the case of wars, which generate global crises and how to adapt to acute geopolitical instability, underscoring the crucial role of institutional actors (Bamberger, 2025) . Considering that it is important to have professionals with high academic standards and, above all, who are up to date with different technologies (Cioccolanti et al., 2026) . The integration of technology in all institutions is important, especially in higher education, which offers transformative potential to improve pedagogical innovation and address changing educational demands. However, effective implementation is required, which necessitates a systematic evaluation of facilitators and the feasibility of implementation in various contexts globally (Zhang et al., 2026) .

Consequently, the importance of technological innovation in higher education is highlighted, where it is evident that, in a complex and changing environment with growing needs, technological tools are used to improve decision-making in order to avoid falling behind and maintain competitiveness (Ahmed et al., 2015; Nieto et al., 2019, and Ulloa-Pimienta et al., 2023). It is mentioned that, as the use of artificial intelligence (AI) becomes increasingly integrated into educational contexts, its impact on students' creative thinking remains uncertain (Baltà-Salvador et al., 2026) .

On the other hand, Hu et al. (2017) focus on the differentiation of higher education in China, while Ulloa-Pimienta et al. (2023) study a university in Mexico. These contextual differences affect the specific strategies and challenges faced by institutions in different parts of the world, which is understood as divergences in results due to a geographical and conceptual approach.

Similarly, Allui and Sahni (2016) criticize human resource management in Saudi universities, highlighting the lack of attention in areas such as faculty recruitment and training. This approach differs from other studies that focus more on strategies and institutional governance, while Adizov (2020) argues that modern strategic management of higher education institutions involves the formation of a corporate culture, the development of a comprehensive development program, and the

implementation of global trends, with an emphasis on human talent management in higher education institutions.

According to the scientific evidence of Sawhney et al. (2017) and Mohana et al. (2022), they could benefit from diversifying the research methods used, such as more extensive comparative studies or additional qualitative analyses to complement their quantitative findings. In this regard, it is recommended that broader and transnational studies be conducted, as suggested by Degn (2015) and others, to better understand global dynamics in university management and governance. This could include comparisons between different educational systems and academic cultures. Likewise, continuing to explore the role of technology, such as the Machine Learning mentioned by Nieto et al. (2019), in improving decision-making and institutional efficiency in higher education. This involves researching new metrics of effectiveness and the application of other technological algorithms. On the other hand, focus on improving human resource management practices, as highlighted by Allui and Sahni (2016), especially in critical areas such as faculty recruitment, training, and retention. This can contribute significantly to long-term institutional satisfaction and performance.

Finally, studies demonstrate the importance of adopting innovative strategic and technological approaches in higher education to improve management, decision-making, and institutional performance. In this regard, the studies reviewed offer a variety of perspectives on strategic management in higher education for efficient and timely decision-making, highlighting both commonalities and significant differences in approaches and contexts. The limitations identified underscore the need for additional research and the implementation of innovative practices to address current and future challenges in the global education sector.

Conclusions

The studies reviewed reveal that strategic management and decision-making in higher education face significant challenges, but also present opportunities for improvement through the implementation of effective strategic practices. To respond immediately to this scenario, it is essential to continue exploring new methodologies and adapting them to diverse contexts, considering the cultural, geographical, and structural differences that influence universities. Technological innovation, such as the use of machine learning, shows promise in optimizing processes and decision-making, highlighting the need for further research in this area. In addition, integrating traditional academic norms with modern management approaches can strengthen institutional identity and improve operational efficiency. In this regard, it is recommended to focus on improving human resource management practices, especially in critical areas such as recruitment, training, and retention of academic staff. This will not only increase institutional performance but also improve staff satisfaction and engagement. In a dynamic global environment, universities must remain agile and adaptable, continuously evaluating their strategies to ensure their long-term relevance and competitiveness. Future research should focus on developing robust theoretical frameworks, conducting cross-national comparative studies, and applying advanced methods of analysis to better understand the complex dynamics within higher education institutions.

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Neuro-Linguistic Programming in the Digital Classroom: Challenges and Opportunities for Effective Implementation

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Introduction

In the contemporary educational setting, NLP has established itself as a strategic resource aimed at boosting student motivation and optimizing academic performance in higher education. NLP techniques are designed to assist individuals in reconfiguring their cognitive and behavioral patterns, promoting knowledge acquisition and communicative interaction (Singh & Alodaynan, 2023). However, despite its potential benefits, its integration into technology-mediated educational contexts faces several challenges. This article aims to identify the barriers and facilitators that impact the operational incorporation of NLP methodologies in educational contexts mediated by digital technologies.

Advances in educational technology have revolutionized the dynamics through which knowledge is transmitted and assimilated, making learning more accessible and improving interaction between students and teachers (Chatzikyrkou et al., 2020). Several studies suggest that the integration of NLP in technological contexts can be an effective means of enhancing students' communication and cognitive skills, although this integration has significant limitations (Coolsaet, 2024). Hossain (2023) points out that educational programs that do not adequately address teacher training in NLP can hinder the effective implementation of technologies.

Existing research tends to focus on the general applications of NLP, while specific studies on its application in conjunction with technological tools are still scarce. The analysis of the effectiveness of these tools must consider the perceptual and technical barriers faced by both teachers and students when adopting new educational tools and methodologies (Singh & Alodaynan, 2023; Coolsaet, 2024). Likewise, the lack of adequate training in NLP within technological curricula has been identified as a significant obstacle (Xu et al., 2023).

Similarly, it is crucial to consider the cultural and situational variables that could influence the operational effectiveness of NLP. Chatzikyrkou et al. (2020) highlight that differences in the cultural perception of these techniques can significantly influence their implementation and acceptance in different higher education environments.

Over the last decade, scientific research on NLP and its implementation in the field of education has expanded significantly, highlighting its ability to strengthen both motivation and academic performance in technology-mediated contexts. However, obstacles and facilitators that affect its effective implementation have also been identified. Below is a summary of five recent studies that analyze the main challenges and opportunities at this intersection.

Centeno-Caamal (2021) examines the potential of the TPACK (Technological Pedagogical Content Knowledge) model as a relevant training structure for qualifying teachers in the articulation of neurolinguistic programming (NLP) with educational technologies. The study highlights that the lack of training in digital and teaching skills is a substantial impediment to such integration.

Similarly, Loachamin et al. (2023) address technological disparities in the Ecuadorian education system, concluding that the lack of technological infrastructure hinders the efficient application of NLP. In this vein, promoting equality in the availability of digital tools becomes essential to ensure that students have equitable access to the benefits of these training methodologies.

From a more specific perspective, Párraga et al. (2024) examine the use of gamification platforms, concluding that they can act as facilitators of learning. Their strategic integration increases student motivation, a key aspect when combined with NLP techniques to foster more dynamic learning environments.

For their part, Coronado and Velásquez (2023) study how training in digital skills influences teachers' pedagogical practices in virtual environments. Their findings indicate that technical training not only improves the use of technologies but also favors the integration of methodologies such as NLP, thus constituting an essential facilitating factor.

Finally, the work of Urueña and Mesa (2024) examines the perceptions of teachers and students regarding the use of technologies during the period of remote instruction caused by the COVID-19 pandemic. The findings indicate that, despite initial obstacles, this experience served as a catalyst for experimenting with innovative approaches, including NLP, in virtual environments.

Taken together, these studies provide a solid overview of the factors that influence the implementation of NLP in technological educational contexts, highlighting the importance of adequate teacher training and supportive environments that favor its application.

Within the field of higher education, NLP is emerging as a strategy with a high capacity to transform the educational experience. However, a critical review of the literature reveals the existence of substantial gaps in relation to its effective application in digital settings. This section examines these gaps based on recent studies and justifies the objective of this article, which focuses on the barriers and facilitators of NLP in technological environments.

The first relevant gap is the limited understanding of how NLP strategies can be effectively integrated with educational technologies in the classroom. Gálvez-Palomeque et al. (2023) state that there are few studies addressing specific teacher training that combines NLP and digital tools, thus limiting its practical implementation.

A second gap relates to the lack of attention to cultural and contextual factors that condition the acceptance and effectiveness of NLP. Cajamarca-Correa et al. (2024) emphasize that the existing literature rarely considers cultural variations in the perception of these techniques, which constitutes a substantive limitation to their effective application.

The third gap revolves around the application of NLP in virtual learning contexts, especially following the expansion of the use of digital platforms during the pandemic. Solano (2024) argues that much research has become obsolete because it has not been updated with new technologies, thus wasting the potential of NLP in these teaching modalities.

Finally, Correa et al. (2024) highlight the scarcity of studies that directly link the implementation of NLP techniques with academic performance, which represents a significant empirical limitation. Exploring this relationship is essential to understanding the true impact of these methodologies on learning.

The objective of this article is to identify the barriers and facilitators in the implementation of NLP techniques within technology-based educational environments. This not only responds to the thematic gaps identified, but also seeks to contribute significantly to knowledge in the field. Addressing the

scarcity of studies on the intersection of NLP and educational technology, the article proposes a detailed analysis of barriers, including technical, pedagogical, and cultural factors, as well as facilitators that could optimize the effectiveness of NLP in digital contexts.

The PRISMA method was used in different stages. The search was carried out in different databases, such as Scopus, Web of Science, Scielo, and Latindex. In order to guide the review process, the following research questions were outlined: 1) What are the barriers perceived by educators in the implementation of NLP techniques in digital educational environments? 2) What pedagogical facilitators have been identified for the integration of NLP in higher education? 3) How does teacher training in NLP affect the implementation of these techniques in technological contexts? 4) What role do cultural perceptions play in the acceptance of NLP within technological educational environments? 5) What are the characteristics of educational contexts that influence the implementation of NLP?

The implementation of NLP in digital educational environments presents various obstacles and facilitators that reflect the complexity of the context in which these techniques are developed. Based on the results analyzed, significant barriers perceived by educators were identified, which are classified into cultural, technical, and economic categories. Research by Testa et al. (2024) indicates that cultural barriers are linked to resistance stemming from entrenched pedagogical traditions, as well as a lack of digital literacy among both teachers and students. This coincides with the findings of Saura (2020) and Pazilah et al. (2023), who also point to gaps in digital skills training as one of the predominant barriers hindering the incorporation of NLP in virtual classrooms. Complementarily, Delgado et al. (2024), and Drigas et al. (2023) argue that the absence of training in metacognitive strategies hinders the effective adoption of NLP, reinforcing the premise that adequate teacher training is essential for its integration into educational processes.

In contrast, the identified pedagogical facilitators offer an enriching perspective on the conditions that optimize the implementation of NLP. Ghosh et al. (2024) highlight that the combined application of NLP techniques with yoga practices strengthened essential learning skills, promoting emotional self-regulation and guided reflection as key elements in fostering student-centered autonomous learning. Similarly, Salvadorinho et al. (2024) demonstrate the positive impact of the Harada model, whose foundations are linked to NLP, in strengthening intrinsic motivation and critical thinking. Poveda (2020) also supports the relevance of these factors as facilitators of learning in innovative educational contexts. However, it should be noted that, despite these promising findings, only one of the studies analyzed applied NLP techniques directly, highlighting the need for further research addressing its practical applicability in digital contexts.

Comparing these findings with previous studies, it can be said that, although there are specific contextual characteristics that influence the implementation of NLP, teacher training and the creation of appropriate learning environments are critical elements in overcoming the barriers identified. In this vein, the review by Karagianni and Drigas (2023) reveals that factors such as teacher resistance and insufficient training directly affect the adoption of innovative methodologies such as NLP, in line with the perceptions gathered in the present study. Likewise, Vega-Feijoó et al. (2020) support this view by emphasizing the importance of reducing institutional resistance through a culture of continuous training.

However, it is essential to recognize the limitations of this study. One of the main limitations relates to cultural and contextual variability among the participating educational institutions, which may have influenced the perception of barriers and facilitators. In addition, the focus exclusively on digital environments may have omitted relevant differences between educational levels and diverse sociocultural contexts. This situation limits the generalization of the findings to other scenarios or stages of education.

Therefore, it is recommended that future research employ methodological designs that address cultural and contextual variations in greater depth. Longitudinal and multicenter studies would allow

for more robust data on the effectiveness of NLP in different educational settings. It is also important to investigate the relationship between specific teacher training in NLP and its effectiveness in virtual environments, as well as to explore students' perceptions of the impact of these techniques on their learning and emotional well-being.

Conclusions

This research has identified key barriers and facilitators in the implementation of neuro-linguistic programming (NLP) techniques in digital educational environments. Among the main barriers are technical and cultural limitations, as well as insufficient teacher training, aspects that have been highlighted in several recent studies. In contrast, emotional self-regulation and the incorporation of inclusive methodologies were recognized as pedagogical facilitators, which are fundamental factors for achieving effective integration of NLP in higher education. These findings not only enrich our understanding of the elements that condition the application of NLP, but also underscore the need to promote continuous training that responds to contemporary technological and pedagogical demands.

In relation to the objective of identifying barriers and facilitators in the implementation of NLP techniques in technology-mediated educational contexts, it has been shown that limited teacher training, deficiencies in digital literacy, and cultural perceptions constitute significant obstacles. At the same time, it has been found that the incorporation of appropriate pedagogical strategies can act as a powerful facilitator for the adoption of these techniques. These results reinforce the need to adopt a comprehensive approach that considers both the limiting factors and the resources available in different educational environments.

This work, developed as a systematic review, has provided a critical and structured overview of the current state of NLP in technological educational contexts. The methodology used, focused on a rigorous review of the scientific literature, has facilitated the contextualization of the findings within a broad theoretical framework, integrating contributions from various contexts and lines of research.

The implications of this study are significant for educational practice. It is suggested that teacher training in NLP be prioritized within professional training programs, aimed at improving digital, pedagogical, and emotional skills. Likewise, it is proposed that future research delve deeper into the analysis of contextual differences that affect the implementation of these techniques, including variables such as gender and sociocultural factors that influence their acceptance and effectiveness. With a focus on continuous improvement and strategic adaptation of educational practices, both researchers and teachers will be able to move towards a more effective integration of NLP, promoting more meaningful, inclusive, and sustainable learning for all students.

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Unseen Forces: Gender Participation in Physics Classrooms

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Introduction

In modern and contemporary societies, Science plays a central role in the lives of citizens. This role is so significant that researchers in Science Education are specifically dedicated to studying how young people engage with Science (Vilia & Candeias, 2020). The underrepresentation of women in STEM (Science, Technology, Engineering and Mathematics) subjects has been a topic of investigation within the Science Education community over the past decades, largely as a result of feminist movements that, since the late twentieth century, have sought to address inequalities and the marginalization of girls within the educational system (Oliveira, 2018). In Portugal, although women outnumber men in overall higher education enrolment, the Statistical Bulletin from the Commission for Equality (Comissão para a Cidadania e a Igualdade de Género (CIG), 2022) reveals that women remain underrepresented in fields such as Engineering (27.1%) and Information and Communication Technologies (17.1%). Only 15.7% of female graduates in Portugal hold degrees in STEM disciplines – a figure that, while still low, is slightly above the European Union average of 13.9%.

Physics plays a central role in STEM disciplines. And many students perceive Physics as a difficult, inaccessible, impersonal, and irrelevant subject (Cottar, 2012). Physics, in particular, remains the scientific discipline that least attracts and retains women, in contrast to areas such as Biology or Chemistry (Abraham & Barker, 2023; Bezen & Derman, 2025). Research teams worldwide (Abraham & Barker, 2023; Francis *et al.*, 2017; Hazari *et al.*, 2017; Zohar & Sela, 2003) have expressed concern regarding the persistent gender gap and are actively seeking strategies to mitigate it and attract more girls to this field of study (Carreño *et al.*, 2022).

The literature indicates that the causes of the gender gap, particularly persistent in fields such as Physics, Engineering, or Computing (Allen, 2018), result from a combination of multiple factors that extend beyond classroom dynamics. Historical and sociocultural aspects play a significant role in shaping how girls feel less identified with Science and Technology. These factors are broad and range from early childhood play (where girls are socially and culturally encouraged to play with dolls rather than building blocks even before entering school) to the differentiated expectations of parents, teachers, and peers regarding boys and girls. Science, and especially Physics, is often perceived as masculine, competitive, objective, and impersonal, which further reinforces these disparities (Brickhouse *et al.*, 2000). Gender is understood as a social concept shaped by the expectations placed on women and men within Western society. Traditionally, physics, as a branch of natural science, has been linked to male perspectives and considered a field largely dominated by men (Bezen & Derman, 2025). The gender stereotype and cultural bias are currently the most frequently cited causes in the literature for the low participation of girls in secondary school Physics, and subsequently in pursuing further studies. Alongside gender stereotypes, self-efficacy – defined as the belief in one's ability to succeed in a task or subject – is also a critical factor (Jammula & Mensah, 2020). The literature (Marshman *et al.*, 2018) suggests that female students, even when achieving high performance in Physics, exhibit significantly lower self-efficacy compared to male students with similar performance levels. These authors argue that this difference is not solely related to academic performance but is influenced by distorted perceptions shaped by sociocultural factors such as gender stereotypes.

To effectively promote gender equality in STEM, teachers need knowledge, skills, and self-efficacy to challenge biases and employ inclusive practices, but their ability to act as agents of change is shaped by both their own beliefs and broader structural constraints (Fernandes et al., 2025). Teachers' gendered perceptions and unconscious biases shape their classroom interactions and expectations, often reinforcing stereotypes that negatively affect girls' confidence, achievement, and participation in STEM (Durrani & Kataeva, 2025). Murphy and Whitelegg, (2006) point out that teachers tend to pay more attention to boys than to girls, largely because boys are more active participants in class and often dominate classroom interactions. As a result, boys receive more feedback – both positive and negative – from teachers. Conversely, since relationships with teachers tend to matter more to girls than for boys, this dynamic can be particularly disadvantageous for female students. When combined with teachers' higher expectations for boys, it further compounds the challenges faced by girls, ultimately impacting their academic performance. While much research highlights these negative impacts, some studies show that teacher-led strategies – such as student-centered activities, female role models, and collaborative group work – can empower girls and promote gender inclusion in STEM (Durrani & Kataeva, 2025).

In light of the factors discussed above, it is essential to take a closer look at the obstacles and facilitators (often called girl friendly strategies) that contribute to the systemic exclusion of girls from Physics. Given the scarcity of research in Portugal on female students views regarding gender issues in Physics Education, this empirical and exploratory study was designed to investigate how these pedagogical dynamics coexist. The study seeks to address the following question: "What are the barriers and facilitators that influence secondary school female students' learning of Physics?"

After transcription, the interviews content was initially analysed through a preliminary reading. Qualitative analysis was employed, specifically content analysis, involving the classification and categorization of responses (which emerged from exploratory readings), with the most relevant ideas and concepts identified according to the research problem, in order to subsequently process the data and interpret the results (Bardin, 2024). After transcription of the content, the WebQDA® software was used for coding the responses into categories.

Each participant was treated as a distinct data source for analytical purposes. Two main categories were identified by the female students: Barriers and Facilitators. Within these categories, a total of 13 subcategories were identified. Among these, the most frequently referenced were the role of peers, the complexity of the subject, and video-classes.

References to "barriers" were more easily expressed than references to "facilitators" of learning or positive aspects of the learning process. Regarding 'barriers', the relationship with peers – particularly with boys – emerges as a significant factor, as highlighted in previous research (Fernandes *et al.*, 2024). This barrier often manifests as "noise," as one student explained: "In 7th, 8th, and 9th grades, they were very noisy." Another student commented, "It was confusing, I won't lie." Some students noted that this behaviour from classmates negatively impacted their learning: "It was really noisy… and that didn't help (…) it ends up being [a barrier]. Not that it's entirely their fault… but it does end up making things harder…".

Another student shared:

"I believe so. Because anyone trying to work on an exercise… for example, I need silence to focus on the questions. And since the boys were always talking, I couldn't really concentrate. Sometimes, someone would say something and then that would take over instead of the exercise. And that really has a negative impact".

Overall, among the barriers mentioned by the female students, the complexity of the subject – linked to the greater difficulty it presents – was cited most frequently, while "assessment" and "lack of prerequisites" were mentioned least often. Based on the data collected, it is clear that difficulties with the subject, due to its complexity, are unanimous – even among students who say they enjoy Physics.

One such student compared her understanding to that of Biology:

"Compared to other subjects, for example, in Biology, the teacher uses a PowerPoint and explains everything so well that we can understand it all. She explains every detail. She starts a topic, explains the entire topic, then reviews it again. Every class. But the Physics teacher doesn't do that. She explains it once, and if we ask about the same question in the next class, she doesn't explain it differently."

In this regard, Zulkiffli *et al*. (2024) state that "Physics builds upon itself" (p. 410), making it essential to grasp the fundamental concepts while simultaneously developing other skills such as mathematics, logic, graph interpretation, and analytical reasoning. Some students specifically mentioned difficulties in these areas: "The question on the test or in the book isn't very clear. I can't really explain it. I think it's hard to understand the wording", and another student shared: "To be honest?... I don't really like Physics because I find it quite complicated… It's because of the formulas and calculations and all that – I just don't like it very much". It is worth noting that three of the students hold Brazilian nationality. One of them did not attend upper secondary education in Portugal. The two students who reported the greatest difficulties are precisely these students. Indeed, (Da Rosa & Rosa, 2012) highlight that, in Brazil—particularly in the context of Physics education—the prevailing teaching model does not incorporate many innovative methodologies. Teachers often face challenges in shifting away from traditional approaches due to a lack of resources, inadequate training, and pressure to achieve results based on conventional assessments. The role of teachers in learning Physics ('Teachers'), the lack of clarity in textbooks ('Textbooks'), and the difficulties related to assessment were the factors least associated with barriers by these female students.

With regard to 'facilitators', the most frequently mentioned subcategories were 'video lessons', 'Socratic dialogue', 'active participation', and 'laboratory activities'. Video lessons were a strategy that was highly appreciated by the female students. The incorporation of technological strategies in the classroom has been increasingly used to engage students with STEM subjects. Studies indicate that video lessons can make physics classes more dynamic and enhance student motivation and interest. Schroeder and Traxler (2017) note that the presence of a human element or humanized features in these videos helps to further increase student engagement with physics content. With regard to laboratory activities, the references provided by the female students are consistent with the literature. (Musasia, 2012) reveals that involvement in meaningful practical work contributes to better performance by girls in theoretical Physics topics. Subsequent discussions allow the students to further develop their analytical skills, particularly in terms of data handling. One of the students in the class referred to the strategy used by the teacher—the Socratic dialog—which was also observed by the researcher. According to (Lestari & Deta, 2021) the Socratic method (originally developed by Socrates) is a questioning-based approach aimed at stimulating critical thinking. The teacher acts as a facilitator, posing questions that challenge students to reflect on scientific concepts, identify contradictions in their answers, or construct explanations based on evidence. The same authors argue that this metacognitive strategy helps develop problem-solving skills in Physics. As one student described her teacher: "She always encourages us to take the initiative. If something is in the textbook, she doesn't like to just give us the answer. She always tells us to think for ourselves".

Regarding the fact that teachers seek alternative explanations whenever female students do not understand ("alternative explanation") or use Physics teaching based on meaningful contexts ("contextualization/real-life examples"), this does not seem to be valued by these students, contrary to what is suggested in the literature (Dare & Roehrig, 2017).

Conclusions

This study provided insights into the key barriers and facilitators influencing female students' learning experiences in secondary school Physics, within a specific context in the Lisbon Metropolitan Area. Although the sample size is limited and not representative of the national population, the findings

offer relevant indications about pedagogical dynamics and gender-related perceptions in Physics education. Participants mainly emphasized barriers, such as the inherent complexity of the subject, peer relationships—especially with male classmates—and the teaching approach itself. Difficulties in understanding the content, combined with teaching strategies that do not always accommodate diverse learning needs, contribute to students' demotivation. Additionally, classroom disruptions caused by male peers were frequently cited as negatively affecting the learning environment.

On the other hand, facilitators like video lessons, the Socratic method, and laboratory activities were valued by students, highlighting the importance of more interactive, visual, and hands-on instructional methods. Interestingly, strategies often emphasized in the literature—such as contextualized teaching and real-life applications—were not widely perceived by the participants as impactful, suggesting a potential gap between theory and classroom practice.Furthermore, it is essential to rethink Physics teaching methodologies, making them more interactive, accessible, and contextualized to students' realities – especially for female students – in order to foster stronger identification with the subject, reduce early disengagement, and encourage interest in scientific careers. For a deeper understanding of this reality, future studies could consider triangulating the data collected from students with insights from teachers and direct observations of what actually happens in the classroom. This approach would allow for a more comprehensive and realistic understanding of pedagogical dynamics and the factors that influence female students' participation in Physics education, thus contributing to the development of more equitable and effective practices within the context of science education in Portugal".

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Global Transformations in Smart Agriculture: Emerging Practices and Policies during the 2024–2025 Biennium

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This summary is part of the institutional research projects of the Corporación Universitaria de Asturias (2025–2027), focused on analysing the impact of emerging technologies in the Colombian agricultural sector, through a comparative approach with international scope. We express our gratitude to the research assistant students, María Beatriz Nisperuza Díaz and Gliserio Hernando Ortiz Burgos, for their valuable contribution to the development of this work.

Introduction

Since the early 21st century, agriculture has undergone a digital transformation that is redefining its productive, logistical, and governance processes. This shift has accelerated through the convergence of emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), geographic information systems (GIS), agricultural robotics, and big data analytics, consolidating what is now known as smart agriculture. This concept refers to the intensive use of digital technologies to increase the efficiency, sustainability, and resilience of agri-food systems in the face of challenges such as climate change, market volatility, and the scarcity of natural resources (FAO, 2022; World Bank, 2023).

The origins of smart agriculture can be traced back to the evolution of precision agriculture—which emerged in the 1990s—and gradually expanded through the integration of remote sensors, wireless connectivity, and advanced automation. Today, the smart agriculture paradigm goes beyond agricultural yield optimization: it incorporates dimensions such as environmental sustainability, digital equity, traceability, algorithmic governance, and automated decision-making (Wolfert et al., 2017; Klerkx et al., 2019). As a result of this evolution, new practices have emerged—such as predictive monitoring, robotic seeding, and digital twins—alongside novel public policies aimed at regulating and incentivizing this technological transition in rural areas (OECD, 2023; ECLAC, 2023).

Within this context, this chapter poses the following research question: How are artificial intelligence, automation, and digital governance being integrated into the agricultural sector during the 2024–2025 biennium, and what lessons can be drawn for public policy design in Latin America? To address this question, the main objective is to comparatively analyse the adoption of smart technologies in the agricultural sector across five strategic countries—Colombia, Brazil, Germany, Japan, and Australia—by identifying patterns in the implementation of emerging practices and the development of adaptive public policies that promote sustainability and competitiveness in the agri-food sector.

From a conceptual standpoint, emerging practices are understood as actions, tools, or processes that arise in response to technological, social, or environmental transformations and are not yet fully institutionalized but reflect innovative trends within agricultural systems (Rotz et al., 2019). Emerging policies, in turn, refer to regulatory frameworks, incentives, or public strategies still in design or pilot phases, aimed at accompanying technological change in contexts characterized by uncertainty and rapid innovation (JRC, 2022).

The scientific contribution of this chapter is articulated across three dimensions. First, it offers an updated synthesis of the most relevant developments in smart agriculture from a comparative and multi-regional perspective. Second, it identifies best practices in technological governance within rural contexts that have successfully integrated public, private, and academic sectors to scale digital

transformation processes in an inclusive and sustainable manner. Third, it presents evidence-based recommendations for strengthening public policy in Latin America, especially in countries such as Colombia, where persistent gaps in connectivity, technical capacity, and regulatory frameworks continue to hinder the effective adoption of smart technologies (García & Martínez, 2023; AGROSAVIA, 2023).

This chapter argues that smart agriculture should not be viewed solely as a technological solution, but rather as an integrated strategy for rural development that demands ethical, inclusive, and context-sensitive governance frameworks. The conclusions assert that the success of its implementation will depend not only on investments in digital infrastructure but also on institutional strengthening, equitable regulation of agri-food data, and targeted technical support for small and medium-scale rural producers.

The review focused on developments between 2020 and 2025, emphasizing the adoption of artificial intelligence, automation, and digital governance across five strategically selected countries: Colombia, Brazil, Germany, Japan, and Australia. The selection criteria prioritized peer-reviewed journal articles, institutional reports, public policy documents, and digital transformation strategies issued by multilateral organizations, national ministries, and research institutions.

Data were gathered from a robust and diverse range of sources. Core scientific databases included Scopus, Web of Science, ScienceDirect, and SpringerLink. Complementary data were drawn from leading international institutions such as the Food and Agriculture Organization (FAO), the Organisation for Economic Co-operation and Development (OECD), the Economic Commission for Latin America and the Caribbean (ECLAC), the World Bank, and the Inter-American Development Bank (IDB). At the national level, additional sources included reports and strategic papers from ministries of agriculture and technology, AGROSAVIA (Colombia), the Joint Research Centre (JRC) of the European Commission, and various observatories on digital agriculture. In total, 91 documents were systematically reviewed, including 45 peer-reviewed scientific articles, 29 technical and policy reports, and 17 national strategy documents on agricultural digital transformation.

To enrich the documentary analysis and validate the emerging findings, twelve semi-structured expert interviews were conducted. Participants were selected using purposive sampling based on thematic expertise, sectoral representation, and international experience. The interviewees included four researchers specializing in agrotechnology and digital transformation, three public officials from ministries or regulatory bodies, three representatives from AgTech startups and technology consortia, and two leaders of producer associations with first-hand experience in digital adoption.

Interviews followed a structured protocol and addressed critical topics such as artificial intelligence deployment in agriculture, barriers to automation, frameworks for digital governance, and ethical concerns regarding data ownership and use.

Analytical Categories

The analysis was structured around three core thematic axes. The first addressed sensor-based agriculture and the Internet of Things (IoT), including the adoption of environmental sensors, satellite monitoring systems, and data-driven agronomic management tools. The second focused on agricultural automation and robotics, such as the use of autonomous machinery, drones, predictive analytics, and algorithmic tools for sowing and harvesting. The third thematic axis examined public policies for digital governance in agriculture, including national strategies, fiscal incentives, regulatory instruments, ICT infrastructure development, and rural digital agendas.

Each axis was analysed through three cross-cutting dimensions: (1) the level of technological implementation, expressed in adoption rates; (2) territorial coverage, with attention to rural–urban disparities and regional patterns; and (3) institutional articulation, referring to the presence, coherence,

and effectiveness of governance instruments and policy frameworks.

To systematize and interpret the data, a combination of qualitative analytical tools was applied. These included comparative country-theme matrices to identify policy gaps and good practices; qualitative coding with ATLAS.ti to map regulatory frameworks, co-occurrence of concepts, and thematic trends; and content analysis to assess strategic alignment, discourse consistency, and institutional narratives. Furthermore, two validation workshops were held with research assistants and selected interviewees to refine the emergent categories and ensure internal consistency and interpretive reliability.

The comparative analysis conducted for this chapter reveals differentiated and asymmetric trajectories in the global implementation of smart agriculture during the 2024–2025 biennium. The countries under review—Colombia, Brazil, Germany, Japan, and Australia—exhibited distinct combinations of technological readiness, territorial coverage, and institutional articulation. These findings directly address the research question posed: How are artificial intelligence (AI), automation, and digital governance strategies being integrated into the agricultural sector in Colombia and other technologically advanced economies, and what lessons can be drawn for public policy formulation in Latin American contexts?

Adoption of AI, IoT, and Automation in Agricultural Systems

Technological adoption rates vary significantly between the Global North and Latin America. Germany and Japan have emerged as frontrunners in integrating AI and Internet of Things (IoT) technologies into core agricultural practices. In Germany, approximately 64% of medium and large-scale farms reported using precision sensors, autonomous tractors, and real-time monitoring systems by early 2025, a process facilitated by federal subsidies and the EU's Green Deal digital alignment (BMEL, 2024; JRC, 2022). Similarly, Japan surpassed 70% adoption, driven by demographic imperatives such as an aging rural workforce and institutional mechanisms ensuring algorithmic transparency and ethical data governance (MAFF, 2024, 2025).

Australia followed with 55% integration of IoT technologies, particularly for water management and remote soil diagnostics in New South Wales and Western Australia (OECD, 2023). Its regionally adaptive model, supported by the Digital Farm Grants Program, has enabled medium-scale adoption despite the country's vast rural dispersion.

In contrast, Brazil and Colombia demonstrate fragmented models. Brazil's Agro 4.0 strategy fostered innovation clusters—especially in Mato Grosso and São Paulo—where over 50% of agro-industrial actors deploy automation tools (ECLAC, 2024). Nonetheless, smallholder farmers remain below 20% adoption due to limited extension services and credit access. Colombia's national figure is even lower, with just 18% of rural producers utilizing digital tools by 2025. High-concentration zones such as Antioquia and Cundinamarca contrast starkly with marginal adoption in regions like Cauca, La Guajira, or Putumayo, revealing a dual-speed transformation (AGROSAVIA, 2023; García & Martínez, 2023).

Territorial Coverage and Regional Gaps

The spatial distribution of digital agricultural innovation underscores persistent structural inequalities. In Germany and Japan, the alignment of national broadband agendas with rural inclusion policies has facilitated relatively even technology deployment across territories (MAFF, 2024; BMEL, 2024). These countries exemplify how digital policy frameworks can counterbalance demographic or economic asymmetries.

On the contrary, Colombia and Brazil show agglomerated adoption in export-oriented corridors, while neglected regions remain digitally excluded. In Colombia, rural broadband penetration is below 30%, hindering digital integration even in high-priority agricultural areas (García & Martínez, 2023). Departments such as Tolima and Meta have benefitted from isolated AgTech pilots, yet rural areas

affected by conflict and structural poverty continue to lag behind (FAO, 2022). These patterns raise concerns about the potential for digital transformation to reinforce, rather than correct, longstanding territorial disparities.

Public Policy and Digital Governance Instruments

Institutional capacity emerges as a key enabler—or bottleneck—in smart agriculture deployment. Germany and Japan possess consolidated frameworks with cross-ministerial coordination, standardized data infrastructures, and well-defined AI ethical protocols (JRC, 2022; MAFF, 2025). Germany's AgriTech Zukunftspakt harmonizes public-private investment with EU sustainability mandates, ensuring policy consistency. Japan's Smart Agriculture Strategy includes KPIs, smallholder participation incentives, and algorithmic accountability mechanisms.

Australia, despite lacking a unified federal model, benefits from targeted interventions at state level. Its moderate policy maturity, coupled with public-private AgTech consortia, has supported a balanced evolution of digital farming practices (OECD, 2023).

Latin American cases are marked by fragmented policy efforts. Brazil has made notable progress through the Agro 4.0 program and its innovation hubs. However, inter-jurisdictional coordination remains inconsistent, limiting scalability. In Colombia, although AGROSAVIA and MinTIC have advanced in pilot development, the absence of a national smart agriculture law, lack of clarity on data governance, and limited institutional articulation present serious gaps (AGROSAVIA, 2023; World Bank, 2023).

Synthesis of Comparative Patterns

These patterns confirm a central argument of this chapter: technological availability alone does not guarantee inclusive digital transformation in agriculture. Instead, sustainable smart agriculture requires integrated governance, coherent policy instruments, and territorially sensitive strategies. Countries that have embedded digitalization within broader equity and innovation policies are better positioned to lead the transition.

Conclusions

The findings presented in this chapter confirm that the digital transformation of agriculture is neither homogeneous nor exclusively technological in nature. Rather, it constitutes a deeply structural transition shaped by institutional, territorial, and socioeconomic factors. Through the comparative analysis of five countries—Colombia, Brazil, Germany, Japan, and Australia—it becomes evident that the successful adoption of smart agricultural technologies depends less on the availability of digital solutions per se and more on the presence of robust regulatory frameworks, coordinated public policies, and an inclusive vision of rural development. In essence, the country's leading the agri-digital revolution are not necessarily those with the highest technological innovation, but those that have strategically embedded such innovation into national frameworks that are ethical, participatory, and territorially balanced.

In the cases of Germany and Japan, institutional maturity and coherence among agricultural, digital, and territorial policies have been decisive in achieving high levels of adoption of artificial intelligence, automation, and data governance systems. In contrast, in Latin America—and particularly in Colombia—the digital transformation of agriculture is advancing unevenly, concentrated in agro-export regions and leaving vast rural areas behind. This reflects a structural gap between technological innovation and territorial equity, posing a serious risk of reinforcing historical patterns of inequality if not addressed through integrated policy responses.

The chapter also highlights that the deployment of intelligent technologies cannot be decoupled from

the development of public policies that guarantee digital rights, adequate infrastructure, and mechanisms for equitable access by small-scale producers. In the absence of such enabling conditions, the implementation of tools such as agricultural sensors, IoT platforms, or predictive algorithms may disproportionately benefit large market actors, thereby perpetuating technological exclusion.

From a scientific standpoint, the central contribution of this research lies in offering a critical, comparative perspective on smart agriculture transformations—moving beyond purely technical or productivity-focused analyses to incorporate political, institutional, and ethical dimensions. By examining issues such as intersectoral coordination, territorial justice, and digital governance frameworks, the chapter broadens the analytical scope of smart agriculture and serves as a valuable input for the design of context-sensitive strategies in emerging economies.

Ultimately, the study concludes that Colombia urgently needs a national smart agriculture strategy that transcends fragmented pilot programs and instead fosters coordinated efforts among ministries, technical institutions such as AGROSAVIA, and territorial stakeholders. This strategy should include clear regulations on data ownership, incentives to facilitate technological adoption by smallholder farmers, and investment in digital infrastructure to guarantee the right to rural connectivity. Only under these conditions can the digitalization of Colombian agriculture become a lever for sustainable development rather than a new driver of exclusion.

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Migration and local cooperation: a comparative study of the cities of Madrid and Aman (2015-2019)

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This text originates from the project Characterization of the profile of the student migrant of Latin American origin in his academic adaptation process at the university at the Universidad Gabriela Mistral in Chile.

Introduction

In the current context of globalization and interdependence, international migration processes and urban expansion pose new challenges for local migration governance. This study focuses on cooperation networks and migration policy diffusion in Madrid and Aman, two capitals with established migrant reception traditions participating in the Migration between Mediterranean Cities (MC2CM) project. While international organizations like the UN and International Organization for Migration (IOM) have limited urban governance roles, city-to-city cooperation networks have enabled local governments to institutionalize international participation and design context-specific migration policies (Filomeno, 2017).

The study applies Filomeno's Relational Theory (2017), conceptualizing migration as a phenomenon rescaled through horizontal interactions between cities and multilevel governance, positioning international cooperation networks and policy diffusion as central analytical axes. Madrid represents a migration governance model characterized by strong horizontal interaction and extensive collaboration with international organizations, associations, and NGOs. This cooperation has promoted inclusive migration policies in education, employment, housing, and political participation, grounded in intercultural and human rights perspectives. Conversely, Aman exhibits a more vertical and centralized governance model, with high dependence on programs managed by international agencies and central government, limiting its autonomy in migration policy design.

This paper analyses these divergent configurations within relational theory frameworks, considering cooperation and policy diffusion networks' importance in explaining autonomy levels and effectiveness in local migration governance (Tshitshi, 2020). It seeks comprehensive understanding of how cities address contemporary migration challenges, emphasizing the need to strengthen local autonomy and multilevel collaboration for inclusive and effective migration policies.

The relational approach, based on Charles Tilly's (2008) postulates and theoretically developed by Felipe Filomeno (2017), proposes a transactional perspective for understanding political and social processes shaping local migration policy. In relational studies of local migration policy, policy adoption and implementation events, alongside influencing local conditions, are viewed as outcomes of cross-locality interactions linking to other places across various scales.

Migration policy conceptualization becomes part of migration governance discourse, though lacking clear definition. Related terms include *regulation*, *restriction* and *migration control*. These policies address diverse areas including integration, humanitarian migration, asylum, labor markets, family reunification, co-ethnic and irregular migration (IOM, 2019). The Governance Framework on Migration

defines migration policies as laws, regulations, projects, and policies related to human movement, encompassing travel and temporary movements, immigration, emigration, nationality, labor markets, economic and social development, social cohesion, social services, health, education, foreign and humanitarian policies.

Filomeno's (2017) Relational approach enables local migration policy analysis through Tilly's (2008) Transactional Ontological notion, focusing on interactions between social sites and resulting characteristics. This approach emphasizes studying how local migration policies impact overall Migration Governance landscapes spanning multiple levels and jurisdictions. Filomeno (2017) articulates this approach across three fields: (a) local urban policies (housing, education, employment); (b) migration policies from higher levels; and (c) multi-scale Migration Governance studies considering vertical (top-down, bottom-up, bidirectional) and horizontal (inter-local government cooperation) articulation (Tommasi & Spiller, 2007).

Horizontal interaction is supported by international cooperation networks and migration policy and practice diffusion processes. Walker (2011) adds three frameworks for studying such interaction: city-scale politics, policy networks, and policy diffusion[1]. This analysis focuses on networks and diffusion mechanisms.

The comparative strategy is justified by its ability to analyse how different cities' local migration policies contribute to Migration Governance models and examine diversity-explaining factors. The research determines how international cooperation networks affect local migration management in these cities. This qualitative approach provides multidimensional perspective, integrating historical, political, and social contexts, facilitating deep understanding of cooperation dynamics and local-level migration governance. This methodology enables hypothesis contrast and generates input for understanding migration policy impact and variation in diverse urban contexts (Czarniawsk, 2004; Esin, Fathi & Squire, 2014).

International cooperation network policy establishment theoretically understood (Filomeno, 2017) as developing institutional links -formal or informal- between governmental actors, international organizations, and civil society organizations, results in migration public policy creation. However, local government realities vary from formal structures and processes to interest-based informal cooperation or minimal cooperation.

This situation occurs because cities have different competencies in migration policy creation, development, and implementation. The absence of structured formal cooperation mechanisms by local governments results from programs linked to national commitments and/or external funding by United Cities and Local Governments, UCLG (UCLG, 2017). Despite this, analysing both cases reveals that international cooperation and policy dissemination have incentivized local migration policy creation in Madrid and Aman.

Comparison between the cities of Madrid and Aman

From Policy Network theory perspectives, Madrid exemplifies advanced collaborative local migration policy management based on extensive cooperation networks with international organizations - including the IOM, UCLG and NGOs, and multiple specialized networks and associations (UCLG, 2019). This articulation has focused Madrid's local migration policies on six priority areas: education, employment, social affairs, discrimination protection, housing access, political participation, migrant population shelter and protection, living condition improvement, diversity management, and

[1]Policy networks: These are sets of formal and informal social relationships between governmental and other actors who share interests in creating and implementing public policies. These networks connect different levels of government (local, regional, national and international) and their variation influences the design and implementation of migration policies. Policy Diffusion: The process by which the policy decisions of one actor influence and are influenced by other decision-makers. Diffusion can occur horizontally, between agencies at the same level, or vertically, between different levels of government, either downward or upward.

intercultural citizenship model promotion.

Institutionally, Madrid's Strategic Grants Plan strengthens cooperation through NGO and international organization partnerships, facilitating collaboration with other regional and national governments. For example, the municipal program *Cuidemos Centro* offers migrant training and employment opportunities through specialized school courses, promoting social integration and strengthening community cohesion. This dynamic reflects horizontal interaction in migration governance, characterized by cooperation network creation and maintenance enabling local migration public policy dissemination (UCLG, 2019).

Aman has approached migration management through programs driven and managed primarily by international bodies and government agencies including the European Union, Swiss Agency for Development and Cooperation, International Rescue Committee, and UCLG (UCLG, 2019). However, local migration policy lacks institutional framework and specific migrant population policies. Integration in Aman is limited to employment, housing, and general social services, without education, vocational training, discrimination protection intervention, or migrant political participation encouragement in local decisions.

Aman municipality's dependence on Jordan's Ministry of Planning and International Cooperation restricts autonomy for establishing international cooperation mechanisms and designing comprehensive policies. This scenario configures predominant top-down vertical interaction (Filomeno, 2017), where national policy directly impacts local migration policies, limiting municipal autonomous strategy development capacity. The Badr Nazzal project represents the most significant exception, being the only permanent public policy socially integrating migrants through international organization, NGO, and civil society collaboration. The cities' differences are based on institutional structure and decentralization degree. Madrid, with high autonomy levels, has a specialized entity—the Government Area of Equity, Social Rights and Employment—promoting intercultural and multilevel migration management approaches. Conversely, Aman is subordinated to central authority, limiting local migration action capacity (UCLG, 2019).

This comparison aligns with Filomeno's (2017) relational proposal, emphasizing local government roles as key migration governance actors through vertical and horizontal interactions (Tommasi & Spiller, 2007). Horizontal interaction strengthens through international networks and migration policy diffusion processes facilitating inter-city learning and cooperation (Walker, 2011), while vertical interaction represents higher-level direct influence on local levels.

According to Local Policy Diffusion theory (Braun *et al.*, 2007; Filomeno, 2017), both Madrid and Aman replicate local migration policies primarily through learning and experience exchange. However, Aman experiences coercive diffusion through ministerial guideline reliance, unable to manage independent migration policies[2]. In Aman, migration service provision falls to NGOs and civil organizations due to lacking local autonomy. Madrid demonstrates cross-cutting migration management with multiple actor participation—including civil society, international organizations, and NGOs—enabling the City Council's Strategic Plan for Human Rights development.

Conclusions

This study analyses how cooperation networks and local migration policy dissemination influence Migration Governance in Aman and Madrid. Madrid operates under horizontal interaction models, collaborating with international organizations such as UCLG, IOM, and UN-Habitat, enabling inclusive policy implementation in employment, health, education, and citizen participation through local

[2] Coercion involves the imposition of national laws and regulations that set parameters for local policies, as well as economic incentives and regulatory pressures that act as softer forms of coercion; Competition arises when local governments develop policies to attract or exclude immigrants, especially to avoid costs associated with certain groups; Imitation occurs when local governments replicate policies from other levels or jurisdictions, facilitated by intergovernmental agreements and knowledge-sharing networks; Finally, Learning occurs when a policy adopted by one local government inspires others to implement it, often through transnational cooperation networks (Shipan & Volden, 2012; Vicino, 2013; Kim & Moon, 2014).

autonomy and intercultural approaches. Aman follows top-down vertical models, limited by central government dependence, though developing some local initiatives partnering with NGOs and international organizations with more fragmented approaches.

The MC2CM project has been instrumental in strengthening both cities' capacities, promoting experience exchange and international cooperation. Differences are explained by institutional frameworks and decentralization levels: Madrid has greater autonomy for designing and implementing local migration policies, while Aman depends on national government structures.

Local governments are key migration governance actors, adapting global norms to local contexts through vertical and horizontal interactions facilitating cooperation and policy dissemination. Recommendations include advancing awareness, shared responsibility, decentralized cooperation, and local role recognition in global migration agendas. He cooperation and dissemination network between Aman and Madrid contributes to building more inclusive and collaborative migration governance models.

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Migrant youth in Colombia: conditions of integration for human security

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This text is derived from the research Jóvenes de Venezuela en Colombia aquí y ahora, developed within the framework of the project Ciudades Sin Borde (Universidad de Antioquia and Casa de las Estrategias) financed by the European Union's Lives in Dignity Grant Facility and managed by UNOPS.

Introduction

Colombia is the main recipient country of refugees and migrants from Venezuela, with around 2.87 million settled in its territory (Plataforma de Coordinación Interagencial para Refugiados y Migrantes de Venezuela [R4V], 2024). Added to the limited institutional experience of international migration in crisis contexts, the magnitude of this displacement has put public care frameworks under pressure and challenged the ways of understanding human mobility in host communities.

In this scenario, migrant youth face unique threats to their human security (from precarious housing and educational exclusion to xenophobia, gender-based violence and the risk of forced recruitment), conditions that do not prevent their capacity for agency and participation. Despite some progress in public policies on reception in Colombia, the absence of an approach that recognizes their trajectories and the limited inclusion of their voices in local agendas persists.

This chapter asks the following question: what material and symbolic conditions influence socialization, participation and access to the rights of Venezuelan youth in urban host environments? To answer this question, a qualitative case study is developed in Cali's District 1, which articulates three frameworks: human rights as a normative horizon, human security to understand risks and capacities, and critical approaches to youth to assess their practices. The findings highlight tensions in migration governance and forms of youth agency, evidencing that human security, educational inclusion and differential approaches should be structural pillars of local integration policies.

Coordinates for interpreting Venezuelan migration

This section presents two focal points to articulate the structural context of human mobility with relevant analytical approaches to the experience of migrant youth: first, to place Venezuelan migration in its historical and political coordinates; second, to examine theoretical perspectives that provide tools for understanding youth integration in host settings.

Migration and regional context

In the last decade, forced displacement has reached historic figures. More than 100 million people were forced to flee their homes in 2022 as a result of conflict, persecution, socio-political crises and protracted humanitarian emergencies (Alto Comisionado de las Naciones Unidas para los Refugiados [ACNUR], 2023). This growth coincides with a weakening of multilateralism, the resurgence of nationalist narratives and the structural precariousness of life, particularly in the Global South.

This phenomenon must be understood in terms of three interdependent processes: globalization and the challenges of global governance, the diversification of migration flows, and their increasing politicization (De Haas, 2020; Thomas, 2001). While globalization has enabled certain forms of mobility, it has also deepened inequalities and exclusions, in part through borders that act as

mechanisms of marginalization by classifying and stigmatizing migrants (Van Houtum & Van Naerssen, 2002). The causes of migration have grown broader and more interconnected (including environmental, economic, health, and political), generating dynamics that overwhelm traditional normative frameworks (McAuliffe & Triandafyllidou, 2021). The COVID-19 pandemic heightened this vulnerability, leaving millions of migrants outside of protection systems (Organización Internacional para las Migraciones [OIM], 2020).

In turn, the political instrumentalization of the migration phenomenon has favored securitarian approaches, stigmatizing narratives and restrictive asylum reforms. Latin America mirrors these struggles: the region is no longer only a source of migration, but also a territory of transit and destination, with increasingly complex flows, such as the Central American 'caravans' or the crossing of the Darién jungle, where the presence of unaccompanied minors is increasing (Fondo de las Naciones Unidas para la Infancia [UNICEF], 2022).

In this context, Venezuelan migration constitutes one of the most significant human displacements of the 21st century. More than 7.7 million people have left the country, 84% of whom have settled in Latin America and the Caribbean (ACNUR, 2022). Characterized by high levels of undocumented status and vulnerability, this diaspora puts a strain on the institutional capacities of host countries.

The largest host country, Colombia has implemented a regularization model that has been internationally recognized for its inclusive approach. Instruments such as the Temporary Protection Statute for Venezuelan Migrants (Estatuto Temporal de Protección para Migrantes Venezolanos [ETPV]) of 2021, and policy documents such as CONPES 3950 (2018) and 4100 (2022), seek to promote progressive integration. However, structural barriers to accessing rights and weaknesses in the refugee system persist (Amnistía Internacional, 2023).

Recent literature has begun to critically explore the tensions between the normative frameworks for reception and the real conditions of human security for the migrant population in Colombia. Studies highlight how territorial power and regularization mechanisms influence migration trajectories by shaping conditions of fear, dignity and access to critical resources (Rochlin, 2023). From a gender perspective, the unique exposure of Venezuelan women and adolescent girls to multiple risks during transit and settlement has been documented, including threats to their personal safety and physical and mental health (Correa-Salazar et al., 2023). In the field of education, normative barriers and discriminatory practices have been identified, limiting effective access to the migrant population, while xenophobic discourses and tensions between migrant and host youth prevail in the school environment (Bellino & Ortiz-Guerrero, 2023; León-Rojas, 2022; Tovar-Flórez et al., 2022).

In light of the above, this study contributes to current research by addressing the integration experiences of migrant youth from a perspective that articulates human rights, human security and youth capacities, through a case study conducted in Cali, a city with particular conditions of unequal urbanization, reception of mixed displacement and fragmented institutional presence.

Approaches to the analysis of migrant youth

Representing over 57% of the total number of migrants in the country (Migración Colombia, 2024), the prominence of adolescents and youth in Venezuelan migration flows to Colombia raises significant challenges regarding the granting of rights, social cohesion and the design of integration policies. Addressing these issues requires a unique approach to youth that recognizes their diverse trajectories and shifts away from adult-centric views that subordinate youth to a 'transitional phase' towards adulthood (Alvarado et al., 2009; Reguillo, 2001; Vommaro, 2015).

From this perspective, youth is conceived as a relational social construction, influenced by specific historical, territorial and power conditions. Consequently, youth should not be seen solely as recipients of policies, but as active subjects in the production of meanings, the transformation of the territories

they inhabit and the redefining of their migratory transits. This interpretation coincides with international normative frameworks such as the Ibero-American Convention on the Rights of Youth (Organización Iberoamericana de Juventud [OIJ], 2005), which recognizes adolescents and youth as strategic actors in development. This is also consistent with the approach of the United Nations, which understands human rights as a historical, progressive and relational structure, based on the inherent dignity of all human beings, regardless of their legal status or nationality.

As for the notion of integration, it is understood as a multidirectional, relational, and rights-guaranteeing process, far from assimilationist or segregationist models. According to the OIM (2019), it is a mutual adaptation between migrants and host societies, involving shared responsibilities to achieve dignified social inclusion and social cohesion, which calls for solidarity and harmonious coexistence. From a broader perspective, Spencer and Charsley (2021) view the concept as a set of processes of personal and institutional change, developed in structural, social, cultural, civic-political and identity-related dimensions, which do not give rise to a state but to continuous dynamics that are shaped over time, in different spaces, scales, and transnational ties.

As formulated by the Programa de las Naciones Unidas para el Desarrollo (PNUD) (1994), the human security approach offers a relevant analytical lens for understanding the integration processes of migrant youth in urban contexts, by shifting the traditional concern for state security towards the holistic wellbeing of individuals. This approach relies on two key principles: protection from chronic threats (such as hunger, disease or repression), and from sudden and painful disruptions to daily life at home, in the workplace or in the community. It further argues that security must be guaranteed in three interrelated dimensions: freedom from fear (survival), freedom from want (livelihoods) and freedom to live in dignity (guaranteed rights) (Commission on Human Security, 2023). The community aspect in particular requires addressing not only rights violations, but also the cultural structures (religious, inter-ethnic, etc.) that shape collective security. This implies understanding how identities, belonging, and bonds are negotiated between migrants and host communities. In the case of migrant youth, this perspective reveals both the risks and the capacities to build agency and networks of care and participation.

The three perspectives mentioned above intersect in the need to think of integration not only as access to rights, but also as a condition for building ties, dignity, and belonging in host environments.

Methodological strategy

This research was developed as a collective qualitative case study, instrumental in nature (Stake, 1995) and descriptive in scope, focusing on the integration experiences of Venezuelan adolescents and youth in Medellín and Cali (Colombia). The project was carried out by the two partner institutions during the 2023–2024 period; however, this chapter focuses on the case of Cali's District 1, under the responsibility of the Universidad de Antioquia team.

The study was supported by the territorial work of the Ciudades Sin Borde strategy, which acted as a gateway to the communities, facilitating access to key actors and the building of bonds of trust, fundamental to the production of situated knowledge. Purposive sampling was applied to capture the diversity and complexity of the case (Stake, 1995). In the exploratory phase, two focus groups were carried out with Venezuelan adolescents and mothers, with the aim of outlining the problem and sharpening the methodological roadmap. Subsequently, semi-structured interviews were conducted with seven parents of young migrants, three teachers from educational institutions, five officials from the institutional response ecosystem, and a focus group with professionals from the Ciudades Sin Borde project who supported pedagogical and psychosocial processes with young people and families.

In addition, a focus group was carried out with young people between the ages of 14 and 18 who had been living in Cali for more than a year and were involved in the school system, as well as two dialogical

encounters with institutional and social actors engaged in the care of the migrant population, centered on the educational and protection challenges of Venezuelan adolescents and youth.

The analysis was anchored in a coding scheme organized in a matrix, with primary and secondary categories of deductive nature, derived from the theoretical framework and complemented by emergent (inductive) categories identified during the review of the corpus. The primary categories included migration experience, access to basic rights, perceptions of personal security, perceptions of community security, physical and material conditions, support networks and participation, psychological conditions, and state institutional response. All documents were coded in Atlas.ti applying rootedness and density metrics, and networks were created to visualize co-occurrences and thematic clusters. The analysis was driven by the identification of both vulnerabilities (susceptibility to being affected by hazards based on the capacity to anticipate, cope, resist and recover) and capacities (existing and necessary competencies to reach human development goals) (PNUD, 2012). Reliability was established through triangulation of sources and instruments, development of analytical memos, inter-coder agreement and logging of decisions in the working protocol.

Regarding ethical considerations, respect for the principles of voluntariness, confidentiality, no harm, and informed consent were guaranteed. Following careful assessment of the safety conditions of the participants, it was agreed that anonymity would be preserved and differentiated consent and assent protocols were implemented for adults and minors.

On the border: Venezuelan youth in Cali

The study carried out in Cali's District 1 made it possible to identify the conditions, experiences and meanings constructed by adolescents and youth of Venezuelan origin in their processes of socio-cultural and school integration, in a peripheral territory marked by a historical vocation of receiving displaced populations and growing urbanization. The findings reveal intertwined dynamics on four levels: living conditions; ways of inhabiting the territory; perceptions of security; and the school as a space of inclusion and conflict.

Living conditions and family ties: family trajectories are marked by structural conditions of socio-economic precariousness, heightened by irregular migration. The families report high vulnerability, although they highlight the progressive improvements associated with obtaining the Temporary Protection Permit (Permiso por Protección Temporal, PPT), which enables access to health services, formal employment and institutional services. This not only influences social integration, but also the construction of civic subjectivity: being "taken into account" emerges as an indicator of symbolic inclusion.

Nevertheless, situations of severe exclusion persist, especially in households lacking valid legal papers. Labor exploitation and informality, lack of access to health care, the burden of care and gender inequality particularly affect female heads of household, whose excessive work demands restrict their capacity for family accompaniment. This leads to a highly unstable environment for their physical and mental health, with cumulative consequences for the well-being of young people.

Ways of inhabiting the territory and community relations: the most significant family community ties are built around the school, which operates as a space for youth socialization and projection. While no experiences of formal participation in grassroots organizations were found, there are initiatives of territorial appropriation and cultural expression through student leadership, participation in school radio stations, neighborhood clean-up days and the creation of collaborative murals, which demonstrate emerging forms of youth agency and contribute to the symbolic restructuring of local space.

However, the dynamics of affective isolation and scarce social cohesion remain, despite displays of solidarity by the host community. The strongest support networks continue to be family or fellow

migrants, in a context where fear of discrimination and xenophobia restrict the expression of identity. The degree of integration is influenced by factors such as length of residence, access to common spaces, age at the time of migration and membership of digital networks such as WhatsApp groups among fellow nationals to access offers and services.

Perceptions of security and experiences of violence: from a human security approach, multiple dimensions of vulnerability were identified. Participating families perceive the consumption of psychoactive substances, youth violence, robberies and micro-trafficking as recurrent threats. In addition, institutional stigmatization practices disproportionately affect the Venezuelan population, undermining their perception of personal and community security.

Although no direct cases of forced recruitment were reported, testimonies of violence based on nationality did emerge. The usual response to aggression and discrimination is withdrawal and silence for fear of escalating the conflict, which reinforces the dynamics of invisibility and hinders access to protection pathways. In this context, migrant mothers adopt strategies of overprotection as a form of sheltering their children, which accentuates youth isolation.

The school as a place of inclusion and conflict: in this area, the findings reveal ambivalence between a school that recognizes differential trajectories and capacities, and an institutional system with limited capacity for adaptation. Teachers value the critical and participatory skills of Venezuelan students, but face difficulties in harmonizing content, assessing prior learning and accompanying processes of emotional and cultural adaptation.

School admission mechanisms, such as diagnostic assessments, are implemented as mechanisms of exclusion when they lack a distinctive approach. Frequently experienced by this population, the experience of over-age students tends to generate frustration if other pedagogical adjustments are not made. In addition, symbolic gaps emerge in the insufficient representation of diverse cultural identities in school and curricular practices.

Despite improvements in the awareness of teachers and the impact of external projects on educational inclusion, a restrictive vision of the concept persists, focused almost exclusively on disability, without effectively integrating the intercultural dimension. Discriminatory practices are not confined to the student body, but involve various institutional actors, which reinforces the need for deeper transformations in school culture.

Conclusions

Cali has made significant progress in providing attention to Venezuelan migrants, including their recognition in development plans and in bodies such as the Comité de Atención para la Población Migrante and the Centro Intégrate. However, public services continue to operate generically, without effective mechanisms to identify, accompany and monitor migrant youth in a targeted manner.

In the educational sphere, schools are seen as an effective setting for social cohesion, and cases of recognition of the social contributions of young migrants (ideas, knowledge, leadership, and resilience) have been observed. However, despite flexible enrolment and the formal guarantee of the right to education, there are still gaps in the assessment of educational trajectories, teacher training in intercultural approaches and the inclusion of migration as a topic in school plans and projects. There is a need for pedagogical support, monitoring dropout rates and fostering the transition to higher education under equal conditions.

The stories of families and youth reflect a progressive improvement in the integration process, as well as the potential for participation. The experience of mobility can also be a source of empowerment and construction of citizenship. In the case of Cali's District 1, the use of networks such as WhatsApp groups provides basic but significant forms of community organization, while sport emerges as a source of integration. The political and civic participation of migrant youth must be strengthened, fostering youth leadership, representation in local spaces and the recognition of their voice in the design of policies.

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Environmental policy, local innovation systems, and eco-efficiency for sustainability

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Introduction

Environmental policy is a set of laws, regulations, methods, and tools that enable the regulation of productive activity within a given territory (Lundquist, 2024), while local innovation systems encourage the organization of actors with diverse interests, promoting the adoption of innovations such as eco-efficiency, which consists of producing various goods with the least amount of resources (Wang *et al.*, 2022). Together, these elements can generate more and better conditions for the sustainability of productive processes and environmental conservation (Cálix, 2022).

In the municipality of Tequila, Mexico there is a strong economic activity related to the alcoholic beverage tequila. Its main raw material is blue agave. The current environmental policy does not have sufficient institutional strength to regulate the processes to obtain this good, so the main input is produced with a low level of sustainability causing a deficient level of conservation of water bodies and soils (Cantillo & Rosete, 2024).

The present study focuses on the coexistence of territorial actors (small and medium-sized producers, municipal officials, and academics, among others) who hold different roles and interests, which do not always align and often lead to discrepancies in their positions regarding the cultivation of blue agave. This raises the question: how can these diverse interests be aligned within an environmental policy framework in order to achieve a more sustainable approach to agave production? In the effort to coordinate the various interests present in Tequila, a local innovation system (LIS) is needed-one that promotes organization and cooperation among actors, replacing antagonistic positions and facilitates the design and implementation of an environmental policy with lines of action based on the perspective of eco-efficiency, aimed at enhancing the conservation of natural resources.

Local innovation system (LIS)

These types of organizational forms – referred to in the present study as LIS –, have a complex nature, are sustained by the cohesion of their constituent elements, and can bring together actors and institutions of diverse affiliations. They have evolved over time, and consequently, the literature has also shifted in terms of the perspectives and objectives associated with these systems (Table 1).

Table 1. Local innovation systems (LIS). Sourse: Own research (2025).

Key point	Author (s)	Year	Proposal
Territory	Aichino & Maldonado	2022	The LIS facilitates the local use of endogenous resources, generating more efficient territorial control.
Innovation	Christopoulos & Wintjes	2024	A LIS requires operating with some of the characteristics of a cluster, which relies on innovation and knowledge to drive regional development in a given area.

Eco efficiency

Eco-efficiency is both a theoretical and technical approach focused on the care and conservation of natural resources in relation to the economic activities of a given territory. It employs multiple tools, such as the environmental discount rate, which assigns a future monetary value to the environmental impact that an industry may generate (Lueddeckens, 2023). Environmental proposals grounded in eco-efficiency can be highly functional and effective when combined with an inclusive environmental policy that is truly regulatory and allows for the integration of knowledge form diverse stakeholder groups in a given region (Lundquist, 2024). In addition to the lines of action derived from an environmental policy proposal, it is necessary to underline the importance of complex thinking to implement actions that articulate the know-how and put into practice theoretical proposals and methodologies to address the environmental issues under study (Díaz-Cuevas *et al.*, 2021). For the design and implementation of policies and regulations concerning the conservation of natural resources and to address the complex socio-environmental situation, it is necessary to rely on at least two analytical pillars: (1) organization and cohesion among the actors interacting within the territory under study, and (2) the application of techniques in the agave production processes that are more environmentally friendly toward the soil, forests, and water bodies. The first of these pillars can be addressed through LIS, while the second can be approached using the techniques and tools of eco-efficiency. A review of the current state of the literature revealed a gap concerning the design of environmental policy based on local innovation systems and eco-efficient production techniques. This theoretical gap, combined with the ongoing environmental degradation in the municipality of Tequila, justifies the development of this research, which aims to propose regulatory guidelines to strengthen existing environmental policies and regulations. The relevance of this study lies in its contribution to and reinforcement of analytical pillars for the design and potential implementation of environmental policies that enable more efficient management of the complex issue of blue agave production in Tequila.

Problem tree

It allows for the visualization of causes; effects and the central problem related to the intensive production of blue agave (also known as *Agave tequilana weber*). The extraction is not sustainable and existing regulatory frameworks have not managed to substantially regulate these production processes. The main problem in the production of blue agave in Tequila is the lack of institutional strength and efficiency in the current environmental policy. Causes of this situation are control of multinational companies in local and international tequila markets, environmental norms and regulations that allows the expansion of blue agave production zones, and weak organization and cohesion among producers. The effects of this situation are the lack of regulation in the production of the crop under study, the contamination of the bodies of water in the territory, the loss of forests, soil erosion and the increase in production costs due to the gradual reduction of the mineral richness of the soil, which implies a greater use of chemical fertilizers.

Objectives tree

It revealed the need to establish production processes with less intensive resource use. To achieve this, a more balanced relationship is required between large companies that market tequila internationally and local blue agave producers, as well as the establishment of a well-organized LIS that can manage the adoption of innovations and support improved negotiation terms between tequila producers and agave farmers. Through this approach, higher levels of sustainability and environmental conservation can be achieved in Tequila.

Stakeholders map

To move from the problematic situation identified in the problem tree to the desired situation defined in the objective tree, a consensus is required among the participants from the stakeholder groups involved in the agave sustainability issue. The directly benefited stakeholders (small and medium-sized blue agave producers, tequila industry workers, and the Tequila community in general) must take three actions: (1) Maintain and strengthen their position, (2) attract those who are indifferent (the tourism industry, financial groups, and large supermarket and grocery chains) with positive arguments, and (3) present critical arguments to opponents (large agave producers, multinational tequila producers and marketers) to weaken their position and attract them to their interests.

Interviews with key witnesses on LIS´s and eco-efficiency

Local innovation systems (LIS)

Common points among interviewees: almost all stakeholders agree that a LIS can provide organization, cohesion, and social proximity to promote environmental policies that increase natural resource conservation in the municipality studied. Points of disagreement among interviewees: there is not enough closeness and trust between the actors involved in the blue agave environmental problem, and without trust it is unlikely that a system such as the one proposed can be established. Alternatives: Active participation by the municipal government is required, given its legal and administrative authority. It is the most appropriate institution to promote citizen participation processes. Similarly, the authorities need solid and clear arguments that generate certainty. The proposed environmental policy, with its lines of action, can contribute to this task of social engagement.

Eco-efficiency

Common points among interviewees: Similar to LIS, the eight actors interviewed view the introduction of more innovative and efficient forms of agave production (cleaner production systems based on ecomaps) as both positive and feasible. These practices can reduce production cost while also lessening pressure on natural resources in the face of highly intensive production. Points of disagreement among interviewees: specifically, producers stated that they did not have sufficient financial resources to fund these eco-efficiency-driven innovations. Meanwhile municipal officials noted that budgetary constraints made it difficult for the municipal government to cover the cost of these technological improvements.

Alternatives: A tripartite action plan is needed. Producers can contribute what they can, while the local government can collaborate with farmers to secure financial support from federal and state governments, as well as from international organizations. Additionally, major tequila companies could contribute both financially and technically, since any negative impact on blue agave production – due to water contamination or declining soil mineral quality- would increase the cost of tequila distillation processes and potentially affect sales of the alcoholic beverage.

Environmental policy proposal

1) The proposal presented below does not aimed to replace the current environmental policy efforts in the territory under analysis, but rather to complement the existing efforts and adapt it to the present problematic context. The lines of action and performance indicators proposed are the result of analytically comparing the diagnosis derived from the LFM with the key informant interviews conducted in the field. Action plan for blue agave cultivation in Tequila:

2) Creation of a technical regulation: derived from the sustainable rural development law, oriented toward the protection and conservation of natural resources in Tequila. This law could be applied across the entire production zone defined by the "Denomination of Origin" to enable integrated environmental management in the region.

3) Strengthen the municipal government´s regulation: regarding the sustainability of agave planting and harvesting processes. These assessments should be conducted by specialist not only from the society, to avoid biased results. Only those existing or new production fields that receive a positive evaluation in the impact assessment and have a municipal license or permit should be allowed to operate. Indicator: Number of environmental impact studies published in official media.

4) Negotiation processes between agave producers and tequila companies: supported by the configuration and harmonization of interests i) production processes with higher degree of innovation that improve efficiency and reduce waste in the transformation of agave, ii) improved planning in the distillation process that allows agave producers to plant and harvest according to a continuous and orderly production schedule, iii) no opening of new production fields; on the contrary, a reduction in intensive production and a transition to organized processes. Indicator: Number of new agreements published in official media.

5) Addressing agave sustainability issues: requires organized production, the adoption of innovations, the strengthening of institutions and laws, and alignment between local economic development goals and environmental conservation. In this regard, LIS´s play a critical role, as they offer a pathway for implementing strategies based on proximity and social cohesion that can promote environmental policy through regulation and territorial ecological planning programs. Indicator: (No. of producers with a land-use planning program/total number of producers) x 100 (%).

6) Given that water is a vital resource: for blue agave cultivation and fieldwork results indicate that it is the natural resource most affected, environmental policy needs to be updated more frequently. Three actions are proposed: (1) Periodically conduct prior consultations with involved actors, (2) This report should be reviewed and certified by stakeholders from different backgrounds to promote inclusion and avoid subjective positions. (3) Once this process has been completed, the information gathered can be used to update municipal regulations. Indicator: Percentage reduction in the volume of water used per hectare of production, compared to previous cycles without technical environmental impact reports.

7) It is a priority to increase the number of wastewater treatment plants: which may operate in three ways: i) owned by tequila companies; ii) owned through joint investments between the government and tequila companies or iii) operated under lease agreements with private companies that provide these services. Indicator: (Volume of wastewater treated/total volume of water used in production areas) x 100 (%).

Conclusion

The issue of environmental conservation resulting from the intensive production of blue agave must be addressed efficiently and in a timely manner. Although it is a current reality, there are still conditions that make it possible and to harmonize environmental policies with those related to economic

degrowth. The problem presented is complex and can be addressed from multiple perspectives. The one addressed in this study is related to complementing existing environmental policy through a LIS enriched by eco-efficiency techniques. This will require greater inclusion and participation of the various actors involved in the agave sector, a broader alignment and configuration of the interests of the different groups interacting in the municipality, and substantial, institutional and active participation of the municipal government - both in social organization processes and in the establishment of more solid environmental policies and regulations aligned with the issues outlined in this study. As a future line of research, it is proposed to further explore the strategies and methods that enable the adoption of an LIS as a means to implement new environmental legislation, policies, and regulations.

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Legislative drafting and gender perspective in peruvian public management: impact of an unconstitutional provision

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This text arises from the CONCILIUM project (931.791) of the Complutense University of Madrid, "Validation of communication models, neurocommunication, business, social networks and gender."

Introduction

Gender equality in Peruvian public institutions has been growing in the last years; with 49.3% of female representation as employees in the civil service in 2024, with a major percentage in subnational governments until 59% (National Authority of Civil Service, 2025). However, according to Chávez (2025), gender violence in the country has been increasing at the same pace with 142.144 reported cases and 12.423 cases just in January of the present year, with psychological and physical aggression. This means that 2025 shows a higher monthly percentage representation compared to the last year. KPMG (2025) exposed that 32.7% of women reported workplace harassment during 2024.

The significance of women in public management is not only a Peruvian topic, because in Latin America, gender equality is an important public policy looking for the female governance in public institutions (Meza *et al.*, 2024). This is a core argument according to Naidoo (2024) who analyses the contradiction between the actions and the message of governments that reduces social cohesion of many population sectors, including women.

Instead of working for a culture of prevention of violence against women, the government, trough the Parliament, has worked the Draft Bill N° 07427/2023-CR, which was approved on April 24. That provision repealed Supreme Decree N° 010-2022-MIMP and N° 013-2023-MIMP. Both were part of national public policies of the Ministry of Women and Vulnerable Populations – MIMP. The first one established the mandatory training in gender perspective for prevention of violence and discrimination in public administration, while the second stated the presence of an equality officer in the same sector.

In that sense, the Legislative Power has gone back in terms of gender equality even when there are statistics that show the seriousness of violence against women, what reinforces the idea of inequality between male and female in decline of professional life and human rights in detriment of development.

Other countries like Thailand and Indonesia develop new legal protections -digital safety- rather than repealing social and mandatory constructions (Ahmad & Smith, 2024) as Peru does against the fourth United Nations Sustainable Development Goal -gender equality- even when is essential for democracy and elimination of disparities and requires to take strategies and challenges.

Certainly, the legislator has produced a draft bill that don't advance in the same way as the public policies around the world, generating a worst public perception of the invisibility of gender violence (Chaparro & Alexander, 2024), where the Parliament legislates against human rights, through the Committee of Women and Family and even with the negative of Executive Power, which shows the theory of Biroli & Rousseau (2025) about a progressive anti-gender activism, including adverse effects

for women.

Along those lines, this research focuses on how the legislative drafting impact on the gender perspective, after the examination of constitutionality of the Draft Bill N° 07427/2023-CR.

Prevention and punishment of violence against women and family members

On November 23, 2015, Peru approved Law N° 30364 in order to prevent, sanction and eradicate violence against women and family members, in all public and private sector, regulating that gender perspective recognize the equality into women and men to develop strategies oriented to self-realization. Complementarily, the human rights perspective in that provision seek to enforce those rights in benefit of women, but, as it was demonstrated, the Parliament is not accomplishing its own law.

That being the case, the actual government in the Executive Power approved a general policy of the current presidential term with the Supreme Decree N° 042-2023-PCM. This policy established the prevention of violence against women as one of the main topics to attend, given that a life without gender violence represents a constitutional right protected by national and international norms like Convention of Belém do Pará (Ramírez, 2019).

In addition, there are strategies to reduce the violence according to Sagot (2008) like (i) taking inequality as the basement of abuse, (ii) empowering with laws, policies and programs, (iii) effective norms to resolve the problem and (iv) protection, sanction and reparation as Convention of Belém do Pará requires; so Supreme Decree N° 010-2022-MIMP and N° 013-2023-MIMP were part of this policies to prevent violence against women in public institutions, moreover during 2024, 95% of workplace harassment were female and 97.45% happened on public sector (National Authority of Civil Service, 2025).

Draft Bill N° 07427/2023-CR : abolition of gender perspective in public institutions

A political party can be defined by the identity, ideology or partisan meaning (De la Cerda, 2025). That draft bill was presented by the parliamentary group Popular Renovation, also a political party based on conservative ideology, specifically on traditional values (Hyunsoo & Eun, 2025) and religion. On April 2, 2024, the objective was to repeal just Supreme Decree N° 013-2023-MIMP to eliminate the equality office on public institutions. The legislative drafting took that project and, under the Presidence of Popular Renovation Party in the Committee of Women and Family, reframed every part of that.

On April 12, 2024, just ten days later, the Committee approved a substitute text with the next arguments:

a) There is not a needing of equality officers according to the explanation of the Peruvian Minister of Women and Vulnerable Populations.

b) It increases public expenditure.

c) It increases hours of work of civil servants.

This occasion, the repeal reached the Supreme Decree N° 010-2022-MIMP that established the mandatory training in gender perspective for prevention of violence and discrimination in public administration, joining another Draft Bills like N° 2921/2022-CR, 5770/2023-CR and 6310/2023-CR, without any kind of objective argument to include this term, lacking proper reasoning.

In that sense, on April 29, 2025, more than a year later, it was put on the agenda to be approved by the Parliament, with the same arguments as the exposed and, finally, on the same day, the Congress debated and just 5 of 130 legislators voted against and 81 voted to approve the draft bill.

To make an analysis of the unconstitutionality of Draft Bill N° 07427/2024-CR, it has been prepared a test of double step: (i) identification of violation of international and national rules and (ii) proportionality test.

First, the next norms were violated by the approval of the enrolled bill, as they constitute unlawful aspects: (i) Convention of Belém do Pará, (ii) Political Constitution of Peru and (iii) Law N° 30364 of prevention and punishment against violence of women and family members.

(i) The 55° article of the Political Constitution of Peru express that every international treaty becomes part of national regulation once that it is subscribed. In that sense, Convention of Belém do Pará was signed to prevent, sanction and eradicate violence against women as it constitutes a clearly human rights violation. Specifically, even the Peruvian State could be a potential aggressor, through the civil servants, as it is regulated on the 2° article. In terms of Velasco (2023), this type of treaties has constitutional status cause human rights are all over the lack of normative and are the basement of society. In addition, violence against women, in an interpretation with the Convention, is a result of prejudice, discrimination and beliefs (Lis, 2024).

(ii) Dignity is the supreme purpose of the Republic of Peru according to the 1° article of the Political Constitution and as Sarma (2025) refers, a way towards dignity is the recognition of human rights, but not just a theorical recognition of a discourse, but rather an action concretized in the reality, what does not happen with this approval. Complementarily, the first item of the 2° article regulates the free development of every Peruvian. These two articles show that human rights are equal for everybody, so the prevention of violence against women perfects dignity. Complementary, the Congress violates the principle of separation of powers regulated on the 43° article of the Constitution, because in detriment of the competences of the Executive Power, the Parliament repeals a provision issued by that power.

(iii) Law N° 30364 was approved on 2015, with two essential perspectives: gender and human rights. Both Supreme Decree N° 010-2022-MIMP and N° 013-2023-MIMP develop the provision as gender equality cannot be achieved, but rather implementing public policies that give effect in the practice. To eradicate violence against women is not just a text, it needs concrete actions like the gender officer and mandatory training in prevention of aggression. That is because gender violence not only affect to women, but rather their families and communities (De la Parra *et al*., 2025).

Based on what has been shown, there is a certainly violation of the entire Peruvian legal system, from international treaties to the Political Constitution of Peru and basic national regulation. This means that the legislator has not analyzed the implications of the provision, even when an action of unconstitutionality could prosper for all these contradictions and infringements of the national and international law.

In second place, Figueroa (2014) reveals that proportionality test is the main item to conclude that a provision is unconstitutional. For that, it starts with the analysis of the two protected legal goods in conflict; dignity and public resources -specifically budget-. The Judgment N° 579-2008-PA/TC of the Constitutional Tribunal of Peru set how the test has to be made according to three phases:

(i) Suitability analysis: the first step is to verify that restricting the right secures the finality of the provision. So, the objective is oriented to save public resources. As it can be seen from the arguments of Draft Bill N° 07427/2024-CR, there is not a social and economic argue that affirms that finality. Moreover, according to the Ministry of Women and Vulnerable Populations in the debate of the final text of the draft bill, there is no spend of budget from the public entities that

has not been analyzed by the Parliament. Dignity must be reinforced with more public policies, not less, and that is why the provision does not pass this part of the proportionality test.

(ii) Needs analysis: the second step is to verify alternative options to achieve the finality of the provision. Dignity is a human right that does not need restrictions, moreover when physical and psychological indemnity are foundations of democracy in Peru. So, if the finality of the provision is to save public resources, there are other options to elect as reduction of public debt, macroeconomic stability, redistribution of budget and investment (Colcha *et al.*, 2023). That is why the provision does not pass this part of the proportionality test too.

(iii) Balancing analysis: this final step is required only in the case if the two other steps were passed, but as it has been demonstrated, neither suitability neither needs analysis have passed.

In that sense, according to what was planted for the analysis of the unconstitutionality of Draft Bill N° 07427/2024-CR, this provision violates the constitutional precepts, what makes that the legislative technique is not suitable in a democratic rule of law. According to García & Eto (2008), the unconstitutionality requires a declaration of the Constitutional Tribunal through a judgment, which effects link the three powers of the State -legislative, executive and judicial- producing general effects too since the next day of publication, only in the processes of unconstitutionality that start in a judge and finishes on the Constitutional Tribunal via appeal for constitutional review.

In every case, it needs the official declaration through a judgment. So, the analysis made on this paragraph contains the arguments for a possible action of unconstitutionality against Draft Bill N° 07427/2024-CR, moreover when the Parliament didn't take any recommendation or observation of the Executive Power, and for insistence, it has been approved again on 12 June, 2025.

Once the unconstitutionality was proved, there are many untechnical aspects to analyze in the process of law approval, as the existence of (i) justification, (ii) technique opinion of the Executive Power, (iii) public opinion / citizen opinion, (iv) violation of national and international provisions and (v) violation of human rights. In the next Table 1, the items are identified for each one of the two regulations:

Table 1. *Inconsistence of Draft Bill N° 07427/2024-CR with technical rigor*

Regulation	Justification	Technique opinion	Public opinion	Violated provision	Violated human right
1. Repeal of mandatory training in gender perspective	No	No	No	Yes	Yes
2. Repeal of equaliy	No	No	No	Yes	Yes

From the analysis of the file documents composed by the opinion of the Committee of Women and Family, substitute text, admissibility and voting report, observations of the Executive Power and online report on the Parliament web, the next elements can be seen:

(i) Justification: both regulations have the same scenario, saving public resources, but there is not any kind of solid argument that enforces the justification. It is a subjective position without objective argues, what means that there is a vice of motivation. It increases when the legislator on both regulations argues that the other reason to eliminate the Supreme Decrees is that the Minister of Women and Vulnerable Populations couldn't answer the questions of the Congress.

(ii) Technique opinion: the Committee said that there was not need to ask the opinion of the Executive Power because it was only a repeal that is a faculty of the Parliament. In addition, the Committee of Production, Decentralization and Justice was exempted to participated on the debate.

(iii) Public opinion: extracted from the opinion of the Committee, there was not this type of opinion from the citizens, so neither technique opinion neither public opinion.

(iv) Violated provision: as it has been demonstrated on the unconstitutionality analysis, there are three provisions, Convention of Belém do Pará, Political Constitution of Peru and Law N° 30364 of prevention and punishment against violence of women and family members.

(v) Violated human right: dignity, physical and psychological indemnity and employment.

The general objective of this research is to evidence the unconstitutionality of Draft Bill N° 07427/2024-CR through the proportionality test by virtue of the Convention of Belém do Pará, Political Constitution of Peru and Law N° 30364, verifying if the legislative drafting was suitable. The specific objectives are as follows: (1) to establish the impact of Draft Bill N° 07427/2024-CR on gender perspective in public institutions and (2) to demonstrate the need of equality officer and mandatory training in gender perspective to prevent violence against women.

For this, it has been made a qualitative analysis of the categories legislative drafting and gender perspective. First, using the proportionality test approved by the Constitutional Tribunal of Peru, a triple analysis was developed: suitability, needs and balancing in order of the two identified protected legal goods: dignity and public resources. Second, using the technique for data collection denominated document analysis of the entire file -census sample- of the draft bill: the full text of Draft Bill N° 07427/2024-CR, the opinion of the Committee of Women and Family, substitute text, admissibility and voting report, observations of the Executive Power and online report on the Parliament web; with the correspondent instrument, document analysis guide validated by expert judgment. For the processing of data, it has been utilized the depuration, structuration and data conversion with triangulation orientated to the perspective of authors and legal system of Peru composed by one international rule and two national provisions. The current impact in public institutions is defined by the unconstitutionality, given that there will be an increasing of reported cases in Peru of gender violence, moreover 95% of workplace harassment were female and 97.45% happened on public sector. The results are in the same tendency of Aranda *et al.* (2024) as they consider that gender violence is enrooted in society and constitutes an obstacle to equality and, also challenge the statistics of National Authority of Civil Service because it is not consistent that the half of civil service in Peru is female and gender perspective is being repealed from the public administration.

Conclusions

It has been demonstrated the unconstitutionality of Draft Bill N° 07427/2024-CR through a technique-legal analysis, for what it is proposed strategic actions like put on media focus the provision and warn an unconstitutionality process for reincorporate both regulations for saving gender perspective and equality value on XXI century in addition to fight against women violence in every entity.

Future works should take a quantitative analysis of the draft bill once it is approved and published on the Official Journal of Peru, focused on the quantity and percentages of gender violence in public institutions.

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Technological Interventions in Autism Spectrum Disorder: Advances and Applications

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Introduction

Autism Spectrum Disorders (ASD) are highly prevalent and heterogeneous neurodevelopmental conditions that present significant challenges in clinical evaluation and neuroeducational intervention (American Psychiatric Association, 2013). Their manifestations include difficulties in social communication, repetitive behaviors, and a wide cognitive variability, from intellectual disability to superior abilities, which demands personalized diagnostic and treatment approaches. Additionally, early signs, such as lack of response to name, limited social attention, or absence of symbolic play, can be observed before 12 months, with alterations such as impaired visual fixation detectable in the first months in siblings of children with autism who are subsequently diagnosed (Jones & Klin, 2013). Furthermore, there is a strong genetic component, evidenced by a 60% to 90% concordance in monozygotic twins (Bailey *et al.*, 1995; Ozonoff *et al.*, 2011).

In recent decades, the prevalence of ASD has experienced a drastic global increase, standing at 1 in 36 children under 8 years old according to the CDC (2023), representing a 22% increase compared to 2021 and 317% since 2000 (CDC, 2023; Maenner *et al.*, 2023). In Latin America, specifically in Colombia, studies such as that by García *et al*. (2022) report a prevalence of 18.7 per 10,000 children between 0 and 14 years old in 2019, although evaluation faces barriers such as lack of access to specialized services, need for professional training, and implementation of validated and culturally and economically adapted tools (MINSALUD y IETS, 2015; Bejarano *et al.*, 2020).

Faced with these challenges, Neuroeducation emerges as a fundamental field, integrating knowledge about atypical brain development in autism with pedagogical principles to create learning environments that capitalize on strengths and address specific needs (Pherez *et al.*, 2018). This field informs about the importance of elements such as structured repetition, predictability, and visual aids, which resonate with the neurological processing patterns of ASD, providing rigor and clinical relevance to technological tools (Pherez *et al.*, 2018). Likewise, current research explores the synergistic integration of technologies such as AI, virtual reality, wearables, and robotics to create multidimensional and holistic solutions (Grynszpan *et al.*, 2014; Dechsling *et al.*, 2023), driven by the inadequacy of conventional responses to an expanding problem (Armijos *et al.*, 2023; Ibáñez-Cubillas, 2022). In this panorama, Information and Communication Technologies (ICT), Artificial Intelligence (AI), Virtual Reality (VR), Machine Learning (ML), robotics, and neuropsychological assessment instruments are emerging as transformative tools to overcome existing limitations (Reichow, 2012), as they offer opportunities to improve the accuracy, efficiency, objectivity, and accessibility of both diagnosis and intervention, allowing the development of highly personalized and evidence-based supports.

Recognizing the imperative need to deepen research into neuroeducational tools for diagnosis and intervention in ASD, this article focuses on examining the impact of technological development on these processes.

The capacity of technology for continuous evaluation and intervention personalization has allowed for fundamental advances. By monitoring progress in real-time and adapting interventions according to individual responses (Bian et al., 2019), technology allows for constant optimization of treatment. This is particularly important in ASD, given the heterogeneity of the condition and the need for highly individualized approaches. Therefore, the future of ASD intervention is moving towards intelligent

systems that learn and dynamically adapt to the changing needs of each individual, offering truly personalized and continuous support. The main lines of research and findings identified in the articles that comprised the final sample are described below.

Impact of Technology-Based Interventions (TBIs) on Social Skills and Communication

The application of VR and AR in ASD interventions has revolutionized the creation of controlled, immersive environments conducive to practicing social skills without the inherent pressures of real-world encounters. Chen *et al.* (2021) engineered a VR system integrated with multimodal sensors, reporting statistically significant enhancements in social interaction metrics among children with ASD. Similarly, Lee & Hsu (2023) explored an AR platform augmented with social stories and computational thinking games, yielding notable improvements in social reciprocity—a critical facet of interpersonal engagement. Johnson *et al.* (2022) assessed the Charisma™ platform, documenting substantial gains in emotion recognition, social inference, and self-schema among young individuals with ASD, with efficacy maintained across both in-person and remote modalities. Beyond direct social applications, AR has demonstrated utility in fostering ancillary skills such as reading proficiency (Khoirunnisa *et al.*, 2024) and working memory capacity (Romero *et al.*, 2023), which indirectly bolster social competence. The adaptive capabilities of these systems, as elucidated by Bian *et al.* (2019) and Matharaarachchi *et al.* (2023), enable tailored feedback and task modulation, facilitating skill generalization from virtual to naturalistic settings—an area warranting further longitudinal investigation.

Socially Assisted Robotics (SAR) leverages the predictable and non-judgmental nature of robotic interactions to engage children with ASD effectively. Zheng *et al.* (2020) conducted a study demonstrating that robotic interventions enhanced joint attention, albeit with inter-individual variability that underscores the need for personalized approaches. Ali *et al.* (2020) compared reinforcement stimuli within robotic therapy, identifying visual and movement cues as particularly efficacious across diverse autism profiles, thus emphasizing customization in intervention design. Lorenzo *et al.* (2023) reviewed the incorporation of collaborative tasks in SAR, advocating for their role in maximizing social learning outcomes. Guerrero-Vásquez *et al.* (2024) developed a robotic assistant targeting emotional learning, with findings indicating that aesthetic and functional design significantly influenced engagement levels. Additional evidence from Rocha *et al.* (2022), Marino *et al.* (2019), and Korneder *et al.* (2024) corroborates SAR's efficacy in advancing socio-emotional comprehension, emotional regulation, and intraverbal skills. The structured predictability of robotic interactions positions SAR as a valuable adjunct to traditional therapies, though its scalability and long-term impact remain underexplored.

Mobile applications and digital platforms offer versatile, accessible avenues for communication enhancement in ASD. Parsons et al. (2020) reported sustained language and social communication improvements following the use of an ICT-based application, with effects persisting up to 12 months post-intervention—a finding suggestive of enduring benefits. Sreekumar *et al.* (2019) documented marked progress in communicative functions among children with complex needs using iPad-based augmentative and alternative communication (AAC) systems. Safi *et al.* (2021) found that virtual voice assistants significantly improved expressive verbal skills and social interactions, while Alzrayer & Banda (2017) provided evidence-based guidelines for educators employing tablet-based tools in educational contexts. Esposito *et al.* (2017) and Koustriava & Koutsmani (2023) further noted cognitive enhancements that support social development, highlighting the interplay between cognitive and communicative domains. The customizable and ubiquitous nature of these tools, as emphasized by Chinchay *et al.* (2024), facilitates continuous skill practice in real-world settings, mitigating logistical barriers and promoting broader skill application.

Video modeling and telepractice have emerged as potent strategies for skill acquisition and care accessibility. Hurwitz *et al*. (2019) employed first-person video recording glasses to deliver immediate behavioral feedback, resulting in measurable refinements in social conduct among adolescents with ASD. Lee *et al*. (2022) compared video modeling with static image-based methods for emotion recognition training, finding both approaches viable yet differentially effective based on individual characteristics. Olcay *et al*. (2023) substantiated the utility of telepractice in skill instruction for young children with ASD, reinforcing its role in extending intervention reach to geographically isolated populations. These modalities enhance self-awareness and equitable access to care, though their comparative efficacy relative to in-person methods requires further empirical scrutiny.

Impact on Cognitive Skills, Well-being, and Learning

TBIs have demonstrated considerable efficacy in augmenting cognitive capacities and academic outcomes in ASD. Lamash & Josman (2019) reported improved task efficiency in a virtual supermarket setting, highlighting metacognitive training's practical applications. Teo *et al*. (2021) utilized a brain-computer interface to enhance attention and social cognition in children with comorbid ADHD and ASD, while Sosnowski *et al*. (2021) integrated eye-tracking technology to refine emotion recognition skills. Krach *et al*. (2019), Liu *et al*. (2021), Macoun *et al*. (2022), Mazon *et al*. (2022), Shurr *et al*. (2020), and Kasuya-Ueba & Toichi (2020) collectively documented gains across diverse cognitive domains—including executive function, mathematical proficiency, and attention—through interactive, adaptive platforms. These findings underscore technology's potential to deliver individualized educational experiences, though the generalizability of these gains to broader academic contexts merits additional research.

Well-being and Emotional Regulation

TBIs also contribute significantly to emotional regulation and psychological well-being. Nguyen *et al*. (2021) introduced the Anxiety Meter, a wearable device that heightened emotional awareness by detecting physiological anxiety cues. Fenning *et al*. (2023) established the equivalence of virtual and in-person mindfulness interventions in alleviating parental stress, broadening mental health support accessibility. Eldeeb *et al*. (2021) leveraged EEG data for distress detection, foreshadowing advancements in bioregulatory technology. Benedicto Rodriguez *et al*. (2024) posited that digital tools could mitigate chronic anxiety, offering secure environments for emotional practice. These interventions collectively enhance quality of life, yet their integration into comprehensive care frameworks remains an area for future exploration.

As things stand, the results of this systematic review reveal a promising and rapidly expanding landscape of technology-based interventions and tools for ASD. The diversity of technologies explored, from virtual reality and robotics to mobile applications and artificial intelligence, underscores the commitment of the scientific and clinical community in the search for innovative solutions for the complexities of ASD. Nevertheless, the field requires rigorous longitudinal studies to ascertain sustained efficacy and seamless integration into daily life. Future research should prioritize validating skill transfer to naturalistic settings and refining technological design through interdisciplinary collaboration. Ultimately, TBIs herald a paradigm shift toward greater inclusion, autonomy, and well-being for individuals with ASD, offering a robust foundation for advancing autism intervention science.

Conclusions

Technology-based interventions (TBIs) are increasingly recognized as effective tools for addressing core deficits in Autism Spectrum Disorder (ASD), particularly in social and communication skills. Virtual reality (VR) and augmented reality (AR) create safe, controlled settings that reduce anxiety, enabling individuals to practice social interactions and apply them in real-world scenarios (Johnson *et al.*, 2022;

Lee & Hsu, 2023). Robots, appreciated for their predictability, encourage joint attention and imitation, aligning with the structured preferences of many with ASD (Ali *et al.*, 2020; Zheng *et al.*, 2020). Mobile apps and digital platforms offer accessibility and customization, supporting ongoing skill practice while overcoming geographic and economic barriers (Parsons *et al.*, 2020; Safi *et al.*, 2021). Telepractice and video modeling deliver direct visual feedback, improving self-awareness and access to advanced social skills training (Hurwitz *et al.*, 2019; Olcay *et al.*, 2023).

In cognitive and educational contexts, TBIs excel due to their interactivity and adaptability. Game-based cognitive training and intelligent tutoring systems tailor learning to individual paces and styles, a feat difficult in traditional education (Macoun *et al.*, n.d.; Mazon *et al.*, 2022). The gamification in these tools enhances motivation and engagement, addressing attention challenges common in ASD (Liu *et al.*, 2021). This indicates TBIs can narrow academic and cognitive gaps, fostering inclusive education.

TBIs also enhance daily living skills and emotional regulation. By simplifying complex tasks with visual or auditory cues, technology promotes independence (Lamash & Josman, 2019; Duncan *et al.*, 2021). Wearable devices encourage healthy habits like physical activity, improving quality of life (Savage *et al.*, 2022). For emotional regulation, TBIs offer safe spaces to explore emotions, using real-time feedback to boost self-awareness and coping skills (Nguyen *et al.*, 2021; Eldeeb *et al.*, 2021; Courtois *et al*. 2024).

Furthermore, technology is revolutionizing ASD diagnosis and assessment. Artificial intelligence and computer vision detect early biomarkers through objective analysis of movement, facial expressions, and gaze, supporting earlier, more precise diagnoses (Ruan *et al.*, 2024; Yuan *et al.*, 2023; Asmethajeyarani *et al.*, 2024). Technological tools enable continuous evaluation and real-time personalization, refining interventions (Bian *et al.*, 2019; Douglas *et al.*, 2021).

Despite these advances, research has limitations. Many studies are small-scale, focusing on initial feasibility, and require randomized controlled trials and longitudinal research to confirm long-term efficacy, skill generalization, and cost-effectiveness. The diverse nature of ASD calls for personalized approaches, a challenge yet to be fully met. Future interventions are likely to involve intelligent, adaptive systems, developed collaboratively with technologists, clinicians, educators, and the ASD community, ensuring ethical, accessible, and person-centered solutions.

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Microenterprise reindustrialization: Challenges and opportunities for a knowledge economy

Zulay Yesenia Ramírez León

Introduction

In an increasingly digitized and competitive economic environment, microenterprises face the challenge of sustaining their productivity, integrating into value chains, and adapting to new market demands. Although they represent the majority of the business fabric in Latin America, their limited access to technology, specialized human capital, and financing prevents them from achieving a profound transformation. In this context, reindustrialization emerges as a key strategy for revitalizing productive sectors from the ground up, with an emphasis on the use of knowledge, innovation, and technology.

This chapter analysis microenterprise reindustrialization as a way to strengthen the knowledge economy in countries such as Colombia, where high levels of informality and undiversified productive structures persist. Through a documentary review of public policies, international programs, and successful experiences, it seeks to understand the main challenges faced by microbusinesses in their transition to more modern and innovative production processes. In particular, it addresses the challenges related to the adoption of Industry 4.0 technologies, the need to develop new job skills, access to specialized financing mechanisms, and the social and environmental impacts of this transformation.

The research question that guides this analysis is: How can microenterprise reindustrialization, leveraged by knowledge, technology, and professional support, improve the competitiveness and sustainability of microbusinesses in Colombia?

To answer this question, this chapter develops four central themes: first, it presents an assessment of the problematic situation of microbusinesses in relation to reindustrialization processes; second, it analysis comparative experiences that allow for the identification of strategies and results relevant to the Colombian context; third, it discusses the impacts, limitations, and conditions necessary for this process to be viable and sustainable; and fourth, it highlights the strategic role of industrial engineers as key actors in the articulation of processes, the implementation of technological solutions, and the transfer of knowledge to the microenterprise sector.

From an argumentative approach that integrates theory, empirical evidence, and contextual analysis, the chapter seeks to contribute to academic reflection and the design of effective strategies for the productive transformation of microbusinesses, recognizing their essential role in building a more inclusive, innovative, and sustainable economy. This integration allows us not only to identify the structural barriers that limit the advancement of microbusinesses in contexts of high informality, but also to highlight the institutional, technical, and human conditions necessary for these actors to evolve within increasingly demanding productive environments. Likewise, the chapter promotes a critical view and a proactive approach on the implementation of public policies , the use of emerging technologies, and the strengthening of professional capacities—especially in industrial engineering—as key elements for revitalizing the local and regional business fabric with a long-term vision.

Microenterprise reindustrialization: problematic situation and analytical approach

Reindustrialization has reemerged as a key strategy for boosting economies, especially in contexts where informality, low productivity, and the fragility of the business fabric hinder sustainable development. In this scenario, microbusinesses, which represent more than 90% of companies and generate around 70% of global employment (World Economic Forum, 2023), face a double challenge: sustaining their daily operations while modernizing their production processes to respond to the demands of a knowledge-based global economy.

In Latin America, and particularly in Colombia, this challenge is exacerbated by the historical lack of coherent and sustained industrial policies, which has led to processes of deindustrialization and economic concentration in low value-added sectors (Cimoli, 2023). Microenterprises, although fundamental in terms of employment and local economic dynamism, tend to operate informally, with limited access to technology, skilled human capital, and specialized financing. This reality limits their ability to innovate, scale up, and actively participate in value chains, perpetuating productivity gaps with larger companies and developed economies.

Reindustrialization, understood as the process of modernizing the productive apparatus through the incorporation of technology, innovation, and strengthening of local capacities (Ross, 2023), presents an opportunity to transform the role of microbusinesses in the economic system. However, its application is neither homogeneous nor automatic. The policies that have promoted this approach in countries such as Germany, China, and the United States, through strategies such as Industrie 4.0 or Made in China 2025, have been made possible by robust industrial ecosystems and state capacities to articulate technological policies with business incentives (Kuo, Shyu, & Ding, 2019). In contrast, in Colombia, the Reindustrialization Policy is just beginning to lay the foundations for a more comprehensive intervention through the creation of Zasca Reindustrialization Centers that seek to adapt support to the characteristics of the local environment (Ministry of Commerce, Industry, and Tourism, 2023; Bogotá Chamber of Commerce, 2024).

The central object of study is, therefore, microenterprise reindustrialization, understood as the process by which microbusinesses adopt technologies, strengthen organizational capacities, and integrate into value networks through innovation, training, and institutional support strategies. This variable is analysed in terms of its potential impact on improving productivity, operational sustainability, and reducing structural gaps in the microenterprise sector.

From this perspective, the following research question is posed:

How can microenterprise reindustrialization, leveraged by knowledge and technology, improve the competitiveness and sustainability of microbusinesses in Colombia?

The structural gaps that exist between Colombian microbusinesses and those located in more advanced productive ecosystems. While in countries such as Germany, China, and the United States, microenterprises benefit from solid industrial policies, access to technology, specialized technical training, and specific financing for innovation, in Colombia these elements are only beginning to take hold. This comparison reinforces the need to design reindustrialization strategies adapted to the local context, where institutional strengthening and coordination between sectors are essential to closing these gaps.

To advance the analysis, we start by recognizing multiple barriers: limited technological appropriation, low investment in infrastructure, lack of specialized training, and limited channels of cooperation with universities and technology centers. In response, strategies such as servitization, strengthening the institutional ecosystem, and academia-industry coordination emerge as viable mechanisms for promoting inclusive reindustrialization adapted to the Colombian context.

Comparative analysis of international strategies for the reindustrialization of microbusinesses

This chapter is based on a documentary review methodology, focused on the critical analysis of specialized secondary sources, public policy reports, indexed academic literature, and international case studies. This approach was chosen because of the need to understand the different paths that different countries have taken to promote the reindustrialization of their productive sectors, with a special emphasis on the inclusion of microenterprises, the use of emerging technologies, and the design of contextualized strategies.

The comparative analysis allows us to observe common patterns, but also important nuances in the way productive transformation has been managed at the local level. Cases such as Germany, China, Italy, South Korea, and the United States show that reindustrialization requires not only cutting-edge technology, but also supporting policies, specialized financing, adequate infrastructure, and strategic alliances between government, business, and academia.

In Germany, the Industrie 4.0 program has been a pioneer in integrating digital technologies into production processes, especially in small and medium-sized enterprises (Kuo, Shyu, & Ding, 2019). This strategy is characterized by strong links with universities, dual training, and technology transfer networks. Similarly, China has promoted the Made in China 2025 program, which focuses on automation and artificial intelligence as key drivers for recovering previously outsourced production capacities (Medina, 2022).

Italy, for its part, has developed the PMInnova program, designed specifically to facilitate the adoption of automation solutions by small businesses and interconnection. This program combines technical assistance , subsidies, and advice on digital transformation (Villa & Taurino, 2019). In South Korea, industrial redevelopment has been promoted that integrates clean industries and small businesses into urban areas, facilitating access to talent, infrastructure, and knowledge networks (Park, 2023).

In contrast, Latin America has experienced a prolonged period of deindustrialization. According to Cimoli (2023), the region has lacked a coherent industrial policy that would enable it to sustain the competitiveness of its productive sectors. Many economies have opted for models focused on the export of raw materials, limiting local technological development and perpetuating uninnovative business structures. In Colombia, the recent creation of the Zasca Reindustrialization Centers marks a significant step forward, offering technical assistance, productive strengthening, market access, and links to financial networks (Bogotá Chamber of Commerce, 2024). However, their impact is still being consolidated and requires rigorous monitoring to ensure their effectiveness.

A comparison of these international experiences reveals similarities in successful reindustrialization strategies applied to micro and small enterprises, as well as differences in the degree of institutional consolidation and programmatic scope.

This analysis reveals that the most successful programs share a common characteristic: a systemic vision of reindustrialization. It is not just a matter of acquiring technology, but of building an institutional environment that facilitates its appropriation, ensures the sustainability of change, and encourages intersectoral collaboration. In this sense, the Colombian case still faces the challenge of transforming pilot experiences into structural, sustainable, and scalable policies for the entire productive apparatus.

Structural challenges and enabling conditions for reindustrialization

The findings of the comparative analysis show that, although reindustrialization is an opportunity to transform the productive capacities of microbusinesses, its implementation faces profound structural

challenges in countries such as Colombia. International experiences show that the success of these processes depends, to a large extent, on the existence of a coordinated ecosystem that combines technology, training, sustained public policies, and multisectoral collaboration networks. In contrast, in contexts where informality, territorial inequality, and low investment in science and technology are prevalent, the effects of reindustrialization tend to be limited and uneven.

One of the main challenges identified is the effective adoption of advanced technologies. In leading countries, such as Germany and China, the digitization of production processes has been accompanied by specialized technical training strategies, financial incentives, and enabling infrastructure. In Colombia, however, many microbusinesses lack the knowledge, operational capabilities, or resources to implement Industry 4.0 technologies (Shen & Zhou, 2024). This technological gap creates a risk of productive exclusion for those actors who fail to adapt to new market dynamics, perpetuating their low productivity and limited competitiveness.

In this context, servitization is emerging as a viable alternative to facilitate the transition of microbusinesses toward more innovative models. The combination of products and services, such as technical support, maintenance, or after-sales advice, allows them to generate added value, differentiate themselves in the market, and establish stronger relationships with their customers. As Jiang, Hu, and Li (2023) point out, servitization not only drives technological innovation but also strengthens human capital and interaction with shared knowledge networks, contributing to business sustainability.

Another critical element is the social impact of reindustrialization. While automation can improve efficiency, it also implies a reconfiguration of employment. Microbusinesses must prepare for this transformation by training their workforce and creating new professional profiles. The case of China, where technology has been progressively integrated with the workforce through the training of robotics technicians and data analysts, shows that it is possible to generate quality employment if structural changes in the labor market are anticipated (Shen & Zhou, 2024). In Colombia, this type of technical training is still limited, especially in peripheral regions, which accentuates the gaps between sectors.

From an environmental perspective, reindustrialization also poses significant challenges. The growing demand for natural resources, especially critical minerals, for technological development poses a risk of ecological imbalance and pressure on vulnerable territories. As highlighted by Berthet et al. (2024), productive transformation processes must incorporate principles of sustainability, circular economy, and corporate social responsibility to prevent technological innovation from deepening social inequalities or generating new socio-environmental conflicts. South Korea's experience in integrating clean industries into urban areas offers an example of how urban design and productive planning can converge in more sustainable models (Park, 2023).

Finally, the discussion shows that no reindustrialization process is sustainable without effective coordination between the state, academia, and the productive sector. University-business partnerships, technology centers, and regional innovation ecosystems play a fundamental role in the generation and transfer of knowledge. Ahmed et al. (2022) emphasize that this collaboration can accelerate applied research, facilitate access to advanced resources, and translate academic innovation into practical solutions for microenterprises. In Colombia, although there are isolated initiatives in this regard, a more structured policy is still needed to facilitate the permanent connection between science, technology, and productive inclusion.

The strategic role of industrial engineering in the reindustrialization of microbusinesses

The reindustrialization of microbusinesses in Colombia requires the intervention of professionals capable of designing, implementing, and optimizing complex systems where people, technologies, processes, and information converge. In this context, industrial engineers play a strategic role by acting as facilitators of technological change, coordinators of production processes, and managers of improvements in environments with limited resources.

Several studies have shown that industrial engineers are key players in the implementation of advanced technologies specific to Industry 4.0, such as the Internet of Things (IoT), cyber-physical systems, and intelligent automation (Kuo, Shyu, & Ding, 2019). Their training enables them to comprehensively address the challenges of operational efficiency, quality, sustainability, and resource optimization in contexts where microbusinesses face structural barriers such as informality, low access to financing, and lack of technological infrastructure.

In emerging scenarios, industrial engineers also take the lead in continuous improvement and progressive digital transformation processes, adapting methodologies such as Lean Manufacturing, Six Sigma, or process design to the realities of smaller-scale companies. As stated by the International Labor Organization (2021), process improvement and the adoption of new technologies applied in microenterprises not only improves their productivity but also facilitates their integration into value networks, their access to new markets, and their formalization.

Furthermore, the profession plays an important role in linking academia and the productive sector. The ability of industrial engineers to connect technical knowledge with the real needs of the productive environment positions them as a key bridge for translating research into applicable solutions. In this sense, the body of knowledge defined by the Institute of Industrial and Systems Engineers (2021) highlights that this discipline allows for the integration of people, materials, equipment, information, and energy into efficient, sustainable, and adaptive systems.

In conclusion, industrial engineers not only provide tools and methodologies, but also the systemic and strategic vision necessary for reindustrialization processes to be viable, sustainable, and inclusive, especially in the microenterprise sector. Their role must be strengthened through public policies that recognize their impact, spaces for contextualized technical training, and partnerships that promote the effective transfer of knowledge.

Conclusions

Microenterprise reindustrialization represents a strategic opportunity to transform the productive capacities of microbusinesses in Colombia and orient them toward a more inclusive, sustainable, and competitive knowledge economy. However, this transition cannot be understood as an automatic or linear process; on the contrary, it requires enabling conditions that ensure its technical, economic, and social viability.

The analysis shows that countries with successful reindustrialization strategies have built robust ecosystems, articulating consistent public policies, specialized technical training, financing mechanisms, and multisectoral collaboration. In contrast, the Colombian context presents structural barriers that limit the impact of such initiatives: low technological appropriation, persistent informality, poor articulation with the education system, and difficulties in accessing credit and infrastructure.

In this scenario, it is necessary to rethink reindustrialization from an adaptive approach, prioritizing local capacity building, strengthening Zasca Reindustrialization Centers, and designing policies that recognize the heterogeneity of the Colombian business fabric. The progressive incorporation of Industry 4.0 technologies can be combined with strategies such as servitization, continuous

improvement, and gradual digital transformation, generating value without excluding those with lower investment or training capacities.

In this process, industrial engineers emerge as strategic actors. Their training allows them to integrate people, processes, technology, and information into efficient, sustainable, and continuously improving production systems. In addition, their role as a bridge between academia and industry facilitates the transfer of knowledge and the adaptation of technological solutions to real contexts, especially in micro-business environments with structural limitations. Industrial engineering offers methodological frameworks and analytical capabilities that are fundamental for reindustrialization processes to not only be implemented, but also to endure and consolidate.

The sustainability of this process also requires integrating a social and environmental perspective into production planning. The technological transition must be accompanied by mechanisms for environmental justice, reduction of labor gaps, and creation of quality jobs. Likewise, it is imperative to consolidate alliances between universities, local governments, business organizations, and community actors to translate academic research into practical solutions that respond to the real needs of the microenterprise sector.

In short, microbusinesses have the potential to play a leading role in Colombia's economic development if they are provided with the right environment to innovate, grow, and formalize. Reindustrialization, rather than a technical goal, is a social process that must be built collectively, with a long-term vision, territorial sensitivity, and institutional commitment. Only then will it be possible to move toward a more diversified, resilient, and knowledge-centered economy.

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Challenges and Opportunities in the Integration of Digital Tools in Teacher Training: A Constructivist Analysis

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Introduction

The gradual incorporation of digital tools into teacher training processes has become essential for the structural reconfiguration of higher education, as well as for the efficient implementation of constructivist pedagogical frameworks. The rapid rise of Information and Communication Technologies (ICT) has profoundly reconfigured not only teaching dynamics, but also the epistemological role of teachers, who now face the challenge of combining their professional training with the digital skills essential for promoting meaningful, participatory learning among their students (Centeno-Caamal, 2021). As the education system transforms in line with the imperatives of the global environment, it becomes a priority to provide educators with relevant resources that enable the consolidation of pedagogical practices centered on constructivism.

From this perspective, the constructivist paradigm posits that students actively construct their knowledge through experiential learning and reflective processes, which requires the competent use of digital technologies that enable this educational journey (Espinosa et al., 2021). However, various teacher training programs still show a substantial disconnect between the integration of digital technologies and constructivist principles, hindering the genuine adoption of these tools in the classroom context (Calle et al., 2022). This situation highlights the urgent need to delve deeper into the exploration and structuring of current frameworks that link the integration of digital tools into teacher training processes and their consistency with constructivist-oriented pedagogical doctrines.

Continuous updating of emerging digital competencies (DC) is essential to ensure that teachers not only have technical mastery of the use of technologies, but are also trained to use them in the configuration of innovative pedagogical methodologies aimed at the development of active learning (Díaz et al., 2022). Despite institutional efforts to strengthen the digital skills of trainers, the specialized literature shows the persistence of structural obstacles, including the absence of comprehensive curricula that coherently link ICT with constructivist principles (Estrada-Araoz et al., 2024). This disconnect between theory and practice demands urgent attention to redesign teacher training approaches, thus enabling a real transition to student-centered teaching guided by constructivist thinking.

In this context, this research aims to conduct a systematic review that analyzes current trends in the inclusion of HD in teacher training programs, examining their degree of alignment with constructivist pedagogical principles. It is argued that identifying and categorizing current models will contribute significantly to the design of more effective training strategies that contribute to improving educational

quality and promoting inclusive and participatory environments in teaching practice (Villavicencio & Zambrano, 2024).

Recent research on digitization in teacher training has shaped a relevant landscape that explores how these technologies can be articulated with constructivist approaches. This systematic review aims to synthesize substantial elements of contemporary studies that provide a broader understanding of the phenomenon in the university setting.

Among the most notable contributions is the work of Banquez et al. (2021), who propose a digital training model aimed at strengthening the educational process. Through a tactic that articulates the strengthening of technological skills, the authors emphasize the importance of faculty not only mastering digital tools, but also critically reflecting on their didactic application in constructivist-oriented settings. This study advocates for the need to train professionals capable of navigating contemporary educational settings with confidence, highlighting the relevance of integrating technologies with learner-centered teaching approaches.

For their part, Aguirre et al. (2022) analyze the relevance of social-emotional skills in the education sector and their impact on the teaching field. They emphasize that teacher training should consider not only technical content but also emotional spheres that favor the creation of substantive learning environments where students are actively engaged with purpose. Through this approach, a comprehensive educational model is proposed that addresses the complexity of the educational process in the digital age.

Similarly, the study by Villacis et al. (2023) examines the operationalization of Universal Design for Learning (UDL) in tertiary education settings. This approach promotes equity and accessibility, fundamental principles for a constructivist pedagogical praxis. The research emphasizes that technological integration must take into account the heterogeneity of the student body, in line with the constructivist postulate that advocates for the personalization of learning and full inclusion.

Additionally, Napa et al. (2023) explore both the potential and the constraints faced by teaching staff when integrating ICT into their professional training process. The study reveals that, despite a growing awareness of the need for teacher digital literacy, opportunities for solid training remain insufficient, which compromises the effective adoption of constructivist strategies in teaching. This finding points to a training gap that urgently needs to be addressed.

Similarly, the research by Salgueira et al. (2022) provides an analytical view of the initial training of secondary school teachers, considering the assessments of students in the teaching practice phase, who recognize the urgency of articulating constructivist theory with actual teaching practice. This study reinforces the notion that teacher training requires a comprehensive approach that combines theory, methodology, and practical experience.

The academic literature highlights notable gaps in the combination of digital technologies and their alignment with constructivist thinking. One of the deficits detected concerns the lack of visibility of the effectiveness of these methods in virtual environments. Although the benefits of the constructivist approach have been documented in face-to-face contexts, research such as that of Naidoo and Mabaso (2023) shows that traditional approaches persist in classroom practice, evidencing a disconnect between the theory adopted and the practices implemented.

A second gap concerns the lack of articulating models that link digital pedagogy with constructivist premises. Väätäjä and Ruokamo (2021) propose a conceptual framework that attempts to amalgamate both dimensions, but its practical applicability in teacher training remains ambiguous. This lack of operational frameworks limits the education system's ability to recognize the challenges of contemporary digital teaching.

In addition, it has been found that a considerable proportion of teachers do not have the necessary skills to implement active learning strategies. According to Rawat et al. (2023), although progress has

been made in assessing digital skills, many educators still do not know how to translate them into student-centered methodologies, highlighting the need for comprehensive training plans.

Added to this is the observation made by Saeed (2022), who warns that, despite their prestige in current educational theory, constructivist pedagogies continue to be questioned in terms of their comparative effectiveness with conventional instructional methods. This reflects poor preparation on the part of training institutions, which hinders the full implementation of the constructivist approach.

Finally, although contemporary pedagogical discourse celebrates digitization as a catalyst for educational transformation, the challenges associated with its implementation persist, resulting in a superficial use of technologies without consolidated didactic support (Zhang et al., 2024). This scenario highlights the need for the present study to fill these gaps through a systematic review that clarifies how to rigorously and coherently integrate HD into FD, in accordance with the principles of constructivism.

The objective of this article is to investigate current approaches to the integration of HD in FD and their alignment with constructivist pedagogical theories. This objective is critical to filling the gaps identified in the literature, such as the disconnect between theory and practice, the lack of clear models of digital pedagogy, the insufficiency of effective CD among teachers, and the challenges in implementing constructivist pedagogy in digital contexts.

The focuses on the incorporation of HD into FD and its convergence with constructivist pedagogical theories, based on the analysis of findings extracted from the reviewed research. Contemporary approaches that emphasize the importance of integrating emerging technologies into educational settings were identified. These advances are radically reshaping the educational environment; however, their implementation poses significant challenges.

According to the studies examined, including that of Siyam et al. (2024), it is concluded that an effective framework for evaluating technological integration in education must focus on the professional development of teachers and the development of specific skills for the pedagogical use of these tools (Rodríguez-Rivas & Muñoz-Solís, 2024). This approach emphasizes the need for continuous training that not only covers technical mastery but also the ability to apply these technologies in a constructivist-based pedagogical context.

Complementary research, such as that by Magaña et al. (2023), provides evidence on the effectiveness of AR and VR-based methodologies, revealing their potential to generate immersive and personalized experiences that promote meaningful learning (Pimentel et al., 2023). This approach is consistent with the constructivist perspective, in which learning is configured as an active process, based on direct experience. However, studies warn that, despite its potential, the integration of these technologies into teacher education faces persistent obstacles, such as a lack of specialized training and resistance to change.

On the other hand, research by Song et al. (2023) shows that the use of generative AI chatbots can invigorate the teaching-learning process, promoting deeper and more meaningful interactions between teachers and students (Romero-Hermoza, 2021). However, this poses additional challenges, including the need for teachers to feel competent and empowered to incorporate these tools into their teaching practice.

Similarly, Moradi's (2023) study suggests that the use of VR-based immersive environments can enhance transferable skills in students, expanding the possibilities for the development of 21st-century skills in constructivist learning contexts (Holguin-Álvarez et al., 2021). However, there is still a need to implement training programs that enable teachers to overcome current barriers to the adoption of these technologies.

Regarding the CD necessary to effectively implement a constructivist approach, Şeren et al. (2023) argue that teachers must cultivate not only technical skills but also higher-order abilities such as critical

thinking and creativity, which are essential in collaborative and dynamic learning environments (Calle et al., 2022). This finding highlights the urgency of designing training programs that promote these skills within real and applicable frameworks.

Likewise, the influence of teachers' perceptions on technology integration has been examined. Kumar and Sharma (2023) highlight that attitudes toward the adoption of AI in the classroom are ambivalent, which can hinder its effective implementation (Pedagogía, 2023). Empirical evidence suggests that it is essential to promote technological literacy and teacher confidence to facilitate the efficient use of these tools.

The convergences identified between this review and previous studies reflect a consensus on the urgent need to strengthen FD in CD. However, there are discrepancies in the reported levels of effectiveness, which can be attributed to contextual variables such as unequal access to technology, lack of institutional support, and individual teacher willingness toward methodological innovation. Despite the growing body of evidence on the pedagogical benefits of these tools, structural limitations persist that condition their appropriation and impact.

Among the main limitations of this study is the reduced possibility of generalizing the results, since many of the studies analyzed are set in specific contexts that cannot necessarily be extrapolated. In this regard, it is recommended that future research address the integration of digital technologies in more heterogeneous settings, considering geographical, socioeconomic, and cultural variables that can enrich the understanding of the phenomenon.

As a guideline for future research, it is recommended that the analysis focus on the long-term repercussions of FD and the incorporation of digital technologies, as well as investigating in greater depth teachers' perceptions of the effectiveness of these tools in the teaching-learning process. Likewise, the study of educational policies that promote inclusive learning environments through the application of digital technologies would be a valuable avenue for expanding the body of knowledge in this area.

Conclusions

The conclusions of this systematic review article emphasize the main findings on the integration of HD in FD and its alignment with constructivist pedagogical theories. Based on a review of the specialized literature, it is highlighted that the incorporation of emerging technologies such as AI, AR, and VR is substantially reshaping the contemporary educational landscape. The studies consulted show that these HDs facilitate access to content and promote active, collaborative, and experiential learning, which are central principles of constructivism. The ability of these technologies to engage students through immersive experiences has been identified as a key motivation for their use, corroborating previous findings that suggest that learning built on direct experience is more effective.

In relation to the objective of this research, which is to investigate current approaches to the integration of HD in FD and their alignment with constructivist pedagogical theories, the findings have provided a comprehensive framework that highlights both the opportunities and challenges of this integration. It has been verified that, despite teachers' favorable predisposition toward the incorporation of digital tools, substantial limitations remain, such as insufficient CD, resistance to transformation processes, and deficiencies in infrastructure and institutional support. These observations point to the urgent need for continuous and specific training that allows educators not only to become familiar with technologies, but also to understand how they can be used effectively within a constructivist framework.

The type of study conducted is a systematic review article, which allows the conclusions to be positioned within a rigorous and structured methodological framework. This review has followed the PRISMA criteria, ensuring that the findings are representative of a constantly evolving field of study

and emphasizing the importance of a critical and reflective view of the integration of technological resources in teaching. The clarity in the presentation and analysis of the information allows readers to better understand how these conclusions were reached and how they relate to the existing literature.

The implications of this research are clearly significant, highlighting the urgent need for further investigation in this area of knowledge. Future studies should delve deeper into the analysis of the long-term influence of teacher training in the use of digital tools, as well as their effectiveness in implementing constructivist-oriented pedagogical approaches. Furthermore, it is essential to examine how educational policies can facilitate learning environments that support the equitable and effective integration of technologies. This study hopes to contribute to existing knowledge and encourage future research that can address the limitations identified, especially with regard to teacher training and the design of more inclusive and adaptive curricula.

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Advancing the Strategic Transfer of Sustainable Technologies through Shared Social Value

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Introduction

In today's world, it is essential to cultivate new ways of thinking and acting that not only allow us to analyze reality, but also to transform economic, social, and technological structures in ways that reimagine both individual and collective lifestyles toward sustainability. Within this context, emerging techno-scientific paradigms are positioning sustainable technologies as strategic assets across multiple fields including Information and Communication Technologies (ICT), nanotechnology, biotechnology, food technology, biodiversity conservation, environmental remediation, energy, sustainable resource management, forestry, water systems, construction, and transportation. In this landscape, scientific and technological knowledge commonly referred to as the knowledge society has become a key strategic resource for advancing sustainable development in all its dimensions, with inclusivity and equity at its core (UNESCO, 2023).

Despite the advancements of the knowledge society, its benefits often remain out of reach for residents of urban slums, positioning them as one of the most pressing challenges in contemporary urban settings. According to the United Nations (2024), approximately 1.12 billion people were living in slum communities worldwide as of 2022. In Latin America, the urban population reached 81% in 2018 and is projected to rise to 89% by 2050 (UN, 2025). This rapid and largely unregulated urban expansion has made the region a prime example of accelerated, unplanned urbanization, producing a wide range of negative impacts on both human well-being and the environment. The most vulnerable city dwellers experience the harshest and most persistent forms of social exclusion, including housing shortages, underemployment, lack of access to essential services, health crises, environmental degradation, overcrowding, poor sanitation, and a breakdown of community and social cohesion.

Within this context, Latin American megalopolises such as Mexico City, Buenos Aires, São Paulo, and Lima are among the most affected by these challenges (ECLAC, 2024). In Mexico, less than 43% of the population lived in urban areas in 1950. However, by 1990 this proportion had risen to 73.6%, increasing further to 80.3% in 2010 and reaching 87.9% in 2025 (World Bank & Worldometers, 2025). As of 2020, Mexico's urban marginalization index stood at 12.1% (National Population Council [CONAPO], 2020). In Mexico City, the municipalities classified with high or very high levels of marginalization include Milpa Alta, Xochimilco, Iztapalapa, Tláhuac, and Magdalena Contreras (CONAPO, 2020; Infobae, 2024).

Building on the above, empowering marginalized urban communities through the transfer of sustainable technologies requires institutions that are not only socially committed, but also guided by a profound sense of human values. These institutions must actively promote the application of sustainable technologies as a strategy to address the persistent unsustainability affecting these sectors. In alignment with this vision, the principle of shared value involves creating both economic and social benefits within communities. As Porter & Kramer (2011) define it, shared value refers to the set of operational policies and practices that enhance a company's competitiveness while simultaneously improving the social and economic conditions of the communities in which it operates.

Carrefour Case Study

Grounded in the previous arguments, this research aimed to design, implement, validate, and refine a strategic model for promoting the transfer of sustainable technologies, guided by the principle of shared value, to benefit marginalized urban communities. This model responds to the urgent needs and complex challenges currently faced by societies worldwide, seeking to foster inclusive development through the convergence of social commitment, technological innovation, and ethical responsibility.

Context description

The Tláhuac Mayor's Office covers 7.5% of Mexico City's territory and comprises seven rural towns with pre-Hispanic or colonial origins: San Juan Ixtayopan, San Andrés Mixquic, Santiago Zapotitlán, San Francisco Tlaltenco, San Pedro Tláhuac, Santa Catarina Yecahuizotl, and San Nicolás Tetelco. According to the Social Development Index (IDS) published by the City Evaluation Council (2025), 31% of Tláhuac's population exhibits low or very low levels of development—comparable to areas facing high relative poverty. Alongside Milpa Alta and Xochimilco, Tláhuac ranks among the three most affected boroughs in terms of social development. The scope of marginalization and poverty in Tláhuac is substantial: 42.2% of its residents are classified as multidimensionally poor, facing challenges such as insufficient income to meet basic needs, educational deficits, limited access to healthcare and social security, poor housing conditions, lack of basic services, and inadequate access to nutritious, quality food.

Tláhuac Technological Institute

The Tláhuac Technological Institute began operations in Mexico City in 2008, in response to the community's need to expand access to higher education and meet the growing demand for student enrollment. Its creation aligned with federal government projections to increase higher education coverage from 25% to 30% nationwide. Every year, however, thousands of young people in the Mexico Valley metropolitan area are excluded from the most in-demand higher education institutions, highlighting persistent barriers to access and the need for expanded educational opportunities in underserved areas.

Model Development: Initial Assessment at the Target Institution

The research followed a conclusive, descriptive, and simple cross-sectional design, as defined by Malhotra (2020). The primary response variable was the Sustainable Development Culture Index (SDI), constructed from four interrelated factors: overall sustainability, along with its three core dimensions—environmental, economic, and social. Each factor was assessed at three distinct levels of analysis, enabling a comprehensive diagnosis of the institution's culture of sustainable development.

Study Subjects and Sample

A stratified simple random sample was conducted using a convenience sampling frame. The population was divided into two strata:

- P1: students who had completed the Sustainable Development (SD) course (n = 744), and
- P2: students currently enrolled or yet to take the SD course (n = 1,418).

From these strata, 254 questionnaires were administered to P1 and 483 questionnaires to P2, ensuring representation across both groups for comparative analysis.

Assessment Instrument

The questionnaire applied was designed with a comprehensive perspective on the environment, understood as a global system encompassing cultural, ecological, economic, political, and social dimensions. Its structure consisted of four sections:

- The first section gathered demographic information, including students' academic program and current semester.
- The subsequent three sections were aligned with distinct levels of analysis:
    - Potential interest in applying sustainability principles in professional contexts.
    - Attitudes toward sustainable behavior.
    - Acquired competencies in sustainable development.
- The instrument included 45 items:
    - The first 30 questions followed a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).
    - The remaining 15 questions were presented in multiple-choice format, aimed at capturing more specific knowledge or practices.

Data Collection and Analysis

The data were processed using SPSS® v. 25 statistical software, analysis. The internal reliability of the instrument was evaluated using Cronbach's analysis, yielding values of 0.926 for Sample 1 (n_1) and 0.879 for Sample 2 (n_2) at the first analysis the instrument. These coefficients indicate satisfactory reliability for this type of questionnaire (Hernández *et al.*, 2014).

The analysis was conducted using quantitative methods. analysis of variance (ANOVA) was applied to identify statistically significant differences between the two population groups (n_1 and n_2), using a confidence analysis $\boldsymbol{\alpha}$ = 0.95. Given the use of a five-point Likert scale for responses, this test was deemed appropriate (Montgomery, 2020).

The variables analyzed across both analysis included gender, major, age, academic semester, and income, with the response variable being the mean scores obtained at each analysis. Additionally, qualitative comparisons were performed using chi-square tests ($p < 0.05$) to detect significant differences between the two populations for the four core factors: environmental, economic, social, and overall sustainability.

ANOVA Test Results: Gender-Based Comparison Between Populations

At Level 1 (potential interest in sustainability within vocational training), statistically significant differences were observed between genders. Female students showed a higher level of interest in

sustainability-related professional pathways, specifically in areas such as: preference for working in companies committed to environmental, social, and economic factors; recognition that sustainable development (SD) enhances competitiveness; concern for the ethical implications of scientific research; and the belief that scientific projects should begin with an ethical assessment.

In contrast, at Level 2 (attitudes toward sustainable behavior), the results reflected a high degree of homogeneity in mean scores between male and female participants in both groups. This suggests that gender is not a determinant factor in shaping attitudes toward sustainable developmental finding supported by similar studies (Pardede, 2023; Murga, 2008), which report that both men and women demonstrate comparable levels of sensitivity to sustainability-related values and challenges.

A noteworthy outcome emerged at Level 3 (skills acquired in sustainable development): students who had not yet taken the SD course scored higher on average than those who had. While this may seem counterintuitive, it suggests the need to strengthen the pedagogical approach of the SD course, particularly by incorporating hands-on, context-driven learning experiences. In this regard, Acosta, Queiruga, and Camargo (2024) point out that the integration of Education for Sustainable Development (ESD) into vocational training remains limited, and emphasize the importance of practical components both within and beyond the classroom. Supporting this, Pettersen (2023), in his study at the Norwegian University of Technology, highlights that sustainability-related content accounts for 50% of the course load and that project-based learning fosters the integration of theory with real-world problem solving.

Analysis of Study Factors

Although the statistically significant differences found were limited, the analyzed factors revealed important trends warranting further discussion.

In terms of the environmental factor, 80% of respondents reported engaging in environmentally responsible actions such as recycling, conserving water and energy, and limiting fuel use. However, only 31% actively avoided purchasing environmentally harmful products, while another 31% expressed indifference toward the planet's unsustainability. This contrast highlights a degree of ecological awareness but also underscores inconsistencies in sustainable thinking, suggesting a certain fragility in students' environmental commitment.

Regarding the social factor, 62% of participants agreed that all individuals have an equal right to enjoy natural resources, recognizing them as common goods shared by humanity. Moreover, a striking 86% affirmed that ethical principles should guide human behavior. These responses reflect a broadly positive orientation among students toward the core values and ethical foundations of sustainable development.

In the sustainability factor, 30% of respondents indicated a lack of interest in seeking information on sustainable development. Nevertheless, 40% expressed interest in participating in sustainability-related projects at the Technological Institute. According to Aznar and Ull (2009), participation is one of the fundamental principles of sustainability in higher education institutions (HEIs), involving active engagement in cultural, scientific, and volunteer activities. In parallel, Tomkinson (2011) emphasizes the integration of sustainable development into the curriculum through student-centered learning, particularly methods based on real-world case studies, as a pathway to consolidate sustainable competencies.

Stage Two: Strategic Plan Design and Indicator Construction

Based on the change factors identified in Block 2 of the model's first stage, a strategic plan was developed encompassing the following elements: a general objective, proposed strategies, lines of action, and corresponding programs or activities. To evaluate the effectiveness of these actions both

internal and external to the institution monitoring indicators were constructed. These indicators serve to determine whether expected outcomes are being achieved and, if necessary, to guide adjustments. For each indicator, baseline values were established to provide a reference framework for tracking progress toward the defined goals.

Stage Three: Second Internal Diagnosis

This diagnostic phase involves comparing indicator values across predefined time intervals set by the institution. In accordance with the model's logic, once sufficient progress is verified through this internal assessment, the process may advance to the model's second phase, which focuses on community level engagement.

Second Stage: Transfer of Sustainable Technologies in the Community

The implementation of the model's second stage commenced 15 months after the initial institutional phase, marking the start of direct work within the community. The process began with a diagnostic assessment involving residents of the Selene neighborhood, located in the Tláhuac municipality. A total of 299 individuals were surveyed to evaluate their environmental perceptions, attitudes, behaviors, and knowledge across five core dimensions: water, air, soil, solid waste, and conservation of soil and biodiversity. The survey employed dichotomous questions (1 = yes, 0 = no), and the response variables included environmental culture (scored on a scale of 0 to 10), with results indicating perceptions (8.6), attitudes (5.6), and knowledge (5.7).

The residents' engagement and receptiveness both in responding to the evaluation instrument and in supporting the institute's proposed technology transfer initiatives—were particularly noteworthy. Analysis of the environmental culture data revealed significant differences only in relation to age and socioeconomic status, emphasizing that while environmental concern exists, economic hardship tends to deprioritize ecological practices in the area. As such, promoting environmental awareness in Tláhuac requires long-term commitment and sustained educational efforts.

Following the diagnostic phase, the strategic deployment of sustainable technology transfer began through a collaborative initiative involving the Tláhuac Technological Institute, the borough authorities, and a local cooperative in the Selene neighborhood. Key activities included:

- Presentation of the project to local government representatives,
- Visit to the cooperative to coordinate the construction of an urban garden,
- Formalization of the collaboration through a signed agreement,
- Training of the institutional work team responsible for implementation,
- Community outreach and awareness campaigns,
- Delivery of sustainability-focused workshops, and
- Installation and automation of the urban garden system (Figure 2).

Figure 1. Activities carried out in the Selene neighborhood



Conclusions

The proposed strategic model stands out for its flexibility and adaptability to the specific conditions of different regions or marginalized urban communities. Its implementation encourages continuous, dynamic improvement, and its methodology and know-how are designed to be transferable and replicable in other related institutions. The model's overarching goal is to benefit marginalized communities through the transfer of sustainable technologies, guided by the principle of shared value.

Following the first institutional phase, the working team concluded that a key element in fostering a culture of sustainable development is the transversal integration of sustainability concepts into the training of future engineers. The Sustainable Development course, offered across all undergraduate programs, is taught with a practical orientation through project-based learning. This approach allows students to explore how sustainability principles intersect with their specific fields of study.

A critical success factor in the first phase was the commitment and engagement of institutional members, who needed to be sensitized, motivated, and well-trained to ensure the effective deployment of the model in the community during the second stage. This capacity building process was essential to generate shared value through the appropriate transfer of sustainable technologies within the model's area of influence.

Ultimately, organizations and institutions today are called upon to go beyond merely fulfilling their objectives they must also contribute as drivers of social and human value. The concept of shared value reframes social challenges as opportunities for innovation, partnership, and meaningful impact. In this sense, issues such as economic and social inequality are not simply policy concerns; they are collective responsibilities that demand action from all sectors of society, especially in contexts where state capacity may be limited.

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Beyond Protocols: Structural Tensions and Institutional Failures in Addressing Gender Violence in Ecuadorian Universities

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This article stems from the work of the Grupo de Investigación para la Transformación Educativa y Social (GITES) and the Observatory of Education at the Pontificia Universidad Católica del Ecuador, which investigate the intersections of gender, power, and educational policy in higher education

Introduction

This study critically examines how Ecuadorian universities address gender-based violence within a robust regulatory framework that, at least on paper, guarantees a gender perspective, non-revictimization, comprehensive redress, and a culture of care. It asks: to what extent do these regulatory mechanisms truly transform the university into an ethical and protective environment, or are they ultimately reduced to bureaucratic compliance that neutralizes their disruptive potential? The general objective is to analyze the tensions between institutional discourse and practice, while the specific objectives are to identify gaps between policy and implementation, examine the limitations arising from insufficient technical, professional, and training capacities, and explore how institutional gray zones often fail to protect those who uphold these processes with ethical and political commitment. From a situated feminist perspective, this work seeks to illuminate the dynamics that reproduce power hierarchies within the university, showing how institutions frequently prioritize the administrative containment of conflict over its structural interrogation. Based on a reflexive systematization of institutional practices and a documentary analysis of internal and national regulations, the study identifies three key dimensions structuring the analysis: (1) the gap between normative gender discourse and its effective implementation; (2) the lack of technical, professional, and training capacities of the teams responsible for applying these regulations; and (3) the consolidation of institutional gray zones that ultimately weaken guarantees and leave those who sustain these processes from a critical commitment unprotected.

Gender-Based Violence in the University: A Structural and Political Problem

Although Ecuador has advanced by developing a public agenda that acknowledges gender inequality and violence against women as structural problems, a significant gap persists within universities. Addressing this violence requires more than procedural compliance; it demands placing it at the center of academic debate, interrogating the knowledges, discourses, and silences that circulate within universities—spaces that shape power, bodies, and rights, where gender-based violence appears in explicit acts and normalized practices.

Higher education is neither a neutral nor a homogeneous domain. Despite its meritocratic facade and claims to universality, it is historically traversed by power relations, disciplinary hierarchies, and symbolic structures that define which knowledges are validated and who is authorized to speak. As Bourdieu (1990) underscores: educational spaces reproduce "the symbolic order of domination" through institutional mechanisms that legitimize certain knowledges while excluding others, often in naturalized ways. Thus, universities become contested terrains where the authorization of discourses

and the positions from which knowledge is produced are continuously negotiated (Connell, 2014). They not only transmit content but also construct meanings about social roles, identities, and the places assigned to women, men, and other subjectivities through pedagogies, epistemologies, and institutional norms. As Bonder and Nari (2001) warn, the hidden curriculum shapes "cultural climates that restrict the autonomy and critical inquiry of female students" (p. 45), reinforcing notions that certain knowledges and capacities are inherently tied to specific groups, thereby limiting the imagination of violence-free spaces.

The creation of protocols, codes of ethics, and specialized committees to address gender-based violence represents an important formal advance. Yet it also risks reducing complex power asymmetries to administrative problems, thereby technocratizing and depoliticizing the issue. By translating social demands into legal procedures, institutions often domesticate the disruptive potential of these claims, turning justice into a technical rather than a political matter (Merry, 2006). Within this dynamic emerge what Rai, Brown, and Ruddick (2019) term institutional gray zones—ambiguous spaces where procedural ambiguity conceals power, enabling the reproduction of hierarchies under a veneer of neutrality. These zones combine regulatory gaps, technical criteria devoid of gender perspectives, implicit expectations of institutional loyalty, and a lack of protections for those who sustain critical interventions. Such conditions are highly functional for institutional orders that privilege administrative stability and reputational safeguarding over ethical and cultural transformation.

This is compounded by the hidden emotional labor imposed on those who maintain these processes out of ethical and political commitment. Hochschild (1983) defined this as "the management of one's own and others' feelings to produce a certain emotional state in another" (p. 7). In universities, this work involves not only bureaucratic or technical procedures, but also mediating experiences of suffering, violence, and deeply asymmetric power relations, often without specialized training or institutional support. This unrecognized emotional cost becomes an invisible burden that universities naturalize and shift onto precisely those upholding such processes.

Moreover, contexts like Ecuador—and much of Latin America—have seen increasing instances of reverse judicialization, where alleged aggressors file criminal complaints for slander or moral damages against victims, faculty, or gender committees. This transforms what should be reparative institutional processes into adversarial legal confrontations, shifts symbolic burdens, and generates a chilling effect that discourages future complaints. As Ahmed (2012) notes, institutions often treat complaints as the problem itself, rather than as revelations of deeper failures (p. 39), thus preserving their structure by rejecting precisely what exposes their deficiencies.

Thus, the convergence of technocratic procedures, institutional gray zones, emotional disciplining, and threats of judicial reprisals illustrates how universities frequently regulate conflict without interrogating the symbolic orders that make gender-based violence possible. In this way, they sustain the promise of gender perspectives at a declarative level, without substantially challenging the patriarchal and hierarchical structures embedded in the academic field. Thus, the university simultaneously embodies a promise of protection and a reproduction of structural violence—a contradiction that this study seeks to unravel.

The findings presented below emerge from a reflexive systematization of cases, internal regulatory documents, and institutional practices concerning how universities address gender-based violence. The analysis uncovers a complex landscape in which a normative discourse that proclaims zero tolerance, gender perspective, and intersectionality coexists with practices dominated by bureaucratization, faculty overload, and the consolidation of institutional grey areas that manage violence more as a reputational risk than as an ethical-political problem.

These results are organized into three major analytical-interpretative axes. The first examines the gap between the normative framework and its implementation, revealing how protocols and codes often

translate into formal circuits that prioritize procedural compliance over integral reparation or cultural transformation. The second addresses faculty overload, hidden emotional labor, and the structural insufficiencies that displace subjective and political costs onto individuals—costs that the system normalizes. The third explores the configuration of institutional grey zones and the disciplining effects of inverse judicialization, where regulatory voids, tacit expectations of institutional loyalty, and legal strategies consolidate a climate of fear and self-censorship, thereby neutralizing the potentially disruptive power of these protocols. Each section weaves empirical evidence with a critical reading that sheds light on the tensions, resistances, and disputes that shape the current university response to gender-based violence.

The gap between normative discourse and practical implementation

The analysis reveals that although the Ecuadorian regulatory framework—particularly the Code of Ethics, the Protocol for addressing gender-based violence, and their derivative instruments—clearly establishes a commitment to eradicating gender-based violence in universities, its effective application is often reduced to a formalistic or merely symbolic level. Most complaints occur between students, frequently linked to poorly managed affective relationships, conflicts following breakups, or moral judgments (such as substance use). Cases involving faculty-student dynamics are less common, and complaints among faculty members even scarcer, yet all reflect formal hierarchies or symbolic power that act as barriers to reporting or proving the facts, increasing the risk of impunity or minimization.

Many of these forms of violence—including sexual assaults and various types of harassment—take place off campus but have a direct impact on academic life. While victims are required to testify only once (upholding the principle of non-revictimization), the process becomes unbalanced when perpetrators appear at hearings accompanied by legal counsel, a level of technical support rarely accessible to victims. This asymmetry is further compounded by a university environment marked by prestige dynamics, informal networks, and social capital that discourage reporting or complicate evidence collection, especially when such behaviors are culturally trivialized as "misunderstandings" or "excesses of familiarity."

The institutional approach activates a bureaucratic apparatus made up of committees, administrative offices, technical boards, and referrals to external bodies, fragmenting the conflict across numerous memos, minutes, and reports. Although the protocol guarantees non-revictimization by ensuring the victim does not repeatedly recount their experience, the multiple procedural stages result in a protracted process focused on documentation and formal compliance, relegating integral reparation and cultural transformation to the background. Immediate measures are generally limited to physically separating the parties and offering psychological support if requested by the victim, without implementing collective mechanisms that challenge the symbolic order sustaining these violences.

As a result, the gender and intersectional perspectives embedded in official documents and protocols are often reduced to technical reports without binding weight in final decisions, while the disciplinary apparatus privileges individual sanctions—warnings, suspensions, or dismissals—without restorative processes or community spaces to collectively address the harm. Below summarizes six key dimensions—type of relationship, reported conduct, institutional processing, immediate measures, use of a gender perspective, and sanction and reparation mechanisms—highlighting the patterns that shape how universities manage gender-based violence and their critical implications for reparation, effective victim protection, and the broader possibility of transforming the power relations that sustain such violence.

From this systematization, Lindemann's (2010) warning becomes particularly salient: when violence is not recognized as such by third parties—or is trivialized and reduced to a mere disciplinary procedure—victims are stripped of their status as legitimate social actors, relegated to suspicion or accusations of exaggeration. This effect is intensified in contexts marked by explicit hierarchies, such

as between faculty and students, or by the weight of academic prestige and informal networks that can overshadow the credibility of testimony. Thus, behaviors ranging from suggestive comments to sexual assaults are frequently read as "misunderstandings" or exaggerations, erasing their structural character and normalizing power relations that perpetuate violence. Even when protocols include gender-based analyses, these are often confined to technical reports with no binding force, while final decisions prioritize disciplinary frameworks. In this way, the university ends up reproducing a model that sanctions individuals without questioning the cultural foundations that enable such violences, forfeiting the opportunity to build genuinely ethical, safe, and transformative community spaces.

Contrast between university normative discourse and its practical implementation in cases of gender-based violence

To delve deeper into the gap between the normative framework and its practical realization, two key instruments —the Code of Ethics and the Protocol for addressing cases of gender-based violence— were systematized, comparing what they enshrine on paper with the patterns observed in their day-to-day implementation. This comparison, structured around four essential dimensions (procedural pathway, immediate measures, gender and intersectionality perspective, and sanction-reparation), illustrates how principles such as zero tolerance, confidentiality, and restorative measures, which appear emphatically in normative texts, in practice operate under predominantly technical and punitive logics, thereby weakening their transformative potential.

This analysis underscores how the university's elaborate regulatory framework projects an image of ethical commitment to rights, gender equity, and prevention, yet in practice becomes a bureaucratic apparatus that fragments cases into files and protocols, prioritizing formal compliance over reparation or cultural change. As Merry (2006) argues, translating social problems into technical routines generates a "legalization of culture" that neutralizes the transformative potential of rights claims. Similarly, Lindemann (2010) highlights how reducing violence to disciplinary files deprives victims of legitimacy, especially amid hierarchies and symbolic capital that can overshadow testimonies. Segato (2016) and Ahmed (2012) further note that institutions often contain conflict to safeguard their image, treating complaints as the problem rather than recognizing them as indicators of deeper structural failures. Thus, under a discourse of zero tolerance and gender rights, the university privileges individual sanctions without collective or restorative processes, ultimately managing violence as an administrative risk rather than confronting its structural roots.

The lack of adequately prepared teams and technical support to effectively implement these regulations

One of the most common institutional strategies to comply with mandates to address gender-based violence has been to incorporate these tasks into faculty workloads, allocating specific hours in semester schedules for participation in ethics committees, student welfare offices, or gender policy bodies. However, in contexts marked by growing enrollments, rising research demands, and extensive administrative duties, this formal allocation proves insufficient to sustain processes that are inherently complex, lengthy, and highly sensitive.

In practice, much of this work extends beyond official hours, imposing an emotional and cognitive burden on faculty that goes largely unrecognized and uncompensated. This reflects what Hochschild (1983) termed *emotional labor*—the management of one's own and others' feelings to achieve institutional ends. Yet in universities, this labor takes on heightened intensity: it involves not just navigating procedures, but mediating experiences of pain, violence, and deep power asymmetries, often without specialized training or institutional support. As a result, the university quietly naturalizes these costs and transfers them onto individuals who sustain these processes out of ethical

commitment, obscuring the depth of their personal and political toll. A particularly troubling dimension is that, aside from experts occasionally tasked with drafting gender-sensitive technical reports, most members of committees, HR offices, and disciplinary panels lack critical training in gender or rights frameworks. Their interventions often remain narrowly procedural, technocratizing violence and reducing its structural roots to a checklist to be closed (Segato, 2016).

This scenario intensifies amid the steady rise in complaints, visible not just in Ecuador but across Latin America following feminist and student mobilizations (Barrancos, 2015; Vaggione & Morán Faúndes, 2021). As Ahmed (2012) argues, institutions frequently treat complaints as problems to be managed, absorbing their disruptive energy into protocols that, absent robust support, merely process grievances without transforming the cultural logics that sustain violence. Thus, assigning hours in teaching plans becomes a formal maneuver that masks the precarization of this work, individualizes responsibility, and perpetuates an institutional logic more invested in fulfilling formal requirements than in challenging patriarchal orders

Institutional gray areas: spaces that fail to protect those acting with ethical and political commitment

A critical review of university regulations, procedures, and daily practices for addressing gender-based violence reveals a particularly concerning phenomenon: the consolidation of institutional gray zones. These are not simply regulatory gaps but ambiguous spaces where technical criteria lacking a gender perspective, tacit expectations of institutional loyalty, insufficient guarantees for those driving critical processes, and the looming threat of reverse judicialization intersect. As Rai, Brown, and Ruddick (2019) observe, such zones are "interstices where institutional power hides within procedural ambiguity, enabling the reproduction of hierarchies under the guise of neutrality" (p. 23). This ambiguity becomes functional, shielding the institution from deeper scrutiny and allowing it to prioritize administrative stability and reputation over substantive ethical or cultural change.

These gray zones become evident in the very design of the bodies charged with handling these cases. Aside from experts occasionally tasked with drafting gender-sensitive technical reports, most members of committees, HR offices, and disciplinary panels lack critical training in gender or rights frameworks. Their involvement typically focuses on fulfilling formal protocol—drafting minutes, following procedural matrices, applying sanction scales—rather than engaging in structural analyses of power and inequality. This is precisely what Merry (2006) critiques: the translation of disruptive social claims into technical procedures domesticates their transformative force, rendering justice a bureaucratic rather than political issue (p. 15). Quantitative matrices used to assess severity are illustrative: while they provide formal consistency, they often strip away a situated political reading of violence, reducing it to checklists detached from broader contexts.

Simultaneously, there is a tacit expectation of loyalty that compels these actors to avoid leaks, public controversies, or "overly political" interpretations. This fosters anticipatory self-censorship, privileging the preservation of institutional image over confronting the power dynamics that underpin gender violence. As Ahmed (2012) argues, "institutions learn to maintain their form precisely by rejecting what exposes their failures" (p. 40), turning protocols into containment mechanisms that ensure complaints do not disrupt too deeply (p. 62). Those who press for more critical perspectives often come to be seen as troublesome or disloyal, undertaking an emotional labor—recalling Hochschild (1983)—that involves moderating their indignation to uphold an appearance of institutional normalcy (p. 56).

This scenario becomes even more complex with the spread of reverse judicialization. Increasingly, alleged perpetrators initiate criminal or civil actions for slander, defamation, or moral harm against victims, faculty, or committee members who issue gender-sensitive findings. This tactic shifts the locus of conflict from the university's protective mechanisms to adversarial legal arenas, where the symbolic burden is inverted and the complainant becomes the accused. Such lawsuits often extend to the

institution itself, forcing universities to divert time and resources to defending the legitimacy of their processes before judicial authorities, to the detriment of developing preventive and educational policies. Thus, what was meant to guarantee violence-free spaces and protect complainants turns into a landscape of legal threats that compounds vulnerability for faculty, committees, and victims alike.

Segato (2016) incisively observes that institutions tend to protect their continuity before ensuring justice, erecting "practical and symbolic walls" that deter any transformation of the patriarchal order (p. 58). This tendency intensifies when those who file complaints or uphold critical findings become targets of litigation designed to discipline attempts to challenge the status quo. In such contexts, the surge in complaints propelled by feminist and student movements (Barrancos, 2015; Vaggione & Morán Faúndes, 2021) encounters university responses that lean toward technocratic administration rather than structural engagement. As deadlines and procedural compliance take precedence, the language of protocols becomes bureaucratic, reducing them to paperwork and weakening their pedagogical and political impact. Echoing Ahmed (2012), complaints are treated "as the problem rather than understood as revealing a problem" (p. 39), reinforcing the disciplinary nature of these gray zones that, far from offering protection, sustain vulnerability and perpetuate cycles of silence.

Conclusions

The analysis shows that, although universities have incorporated protocols, codes of ethics, and formal mechanisms that outwardly signal a commitment to eradicating gender-based violence, their implementation largely results in bureaucratic circuits focused on procedural compliance rather than transforming the imaginaries and power structures that sustain such violence. The lack of professional, technical, and financial resources—coupled with the absence of specialized training—shifts this institutional burden onto individuals, generating what Hochschild (1983) describes as "emotional labor," a costly and largely invisible demand. At the same time, the consolidation of institutional gray zones—marked by regulatory ambiguities, implicit expectations of loyalty, and the risk of reverse judicialization—fosters a climate of self-censorship and fear, ultimately stifling the transformative potential of these mechanisms. As Ahmed (2012) observes, in such contexts "complaints are treated as a problem rather than understood as revealing a problem" (p. 39), allowing institutions to maintain their structure by resisting precisely what exposes their failures. Thus, the university emerges as a space that manages conflict without interrogating the symbolic orders that enable violence, leaving the promise of a gender perspective more at the declarative than the practical level. This highlights the urgent need to reconceptualize these mechanisms from a political and collective perspective capable of challenging the cultural and hierarchical foundations that uphold gender-based inequality in higher education.

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Subjective Working Conditions and Engagement in Healthcare: A Post-Pandemic Analysis Based on the Job Demands–Resources and Conservation of Resources Models

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This text originates within the framework of an institutional study approved by the Regional Hospital Honorio Delgado Espinoza (Resolution No. 471-2024-GRA/GRS/GR-HRHD/DGOCDI), in the context of the pandemic's impact on occupational health, psychosocial well-being, and the performance of healthcare personnel in public health systems across Latin America.

Introduction

The COVID-19 pandemic fundamentally altered healthcare work worldwide, introducing unprecedented pressures that have reshaped staff well-being and work engagement (Wang et al., 2023). In the post-pandemic landscape, traditional arrangements of tasks, roles, and supports have shifted, making it essential to clarify how subjective working conditions—workers' perceptions of fairness, recognition, autonomy, workload, and organizational support—relate to engagement (Hu et al., 2022). This requires theoretical lenses that capture both the structure of work and the dynamics of resource change over time.

The Job Demands–Resources (JD-R) model offers a first lens by distinguishing between job demands that entail sustained effort and potential costs, and job resources that facilitate goal attainment, reduce demands, or foster growth (Bakker & Demerouti, 2017). JD-R posits a health-impairment pathway (excessive demands → exhaustion/burnout) and a motivational pathway (adequate resources → vigor, dedication, absorption). In healthcare, the pandemic amplified demands—clinical overload, time pressure, emotionally taxing care, uncertainty about protocols, and heavier administrative loads—while destabilizing key resources including social support, professional autonomy, recognition, development opportunities, and work–life balance (Lesener et al., 2020).

Complementarily, Conservation of Resources (COR) theory explains how individuals obtain, maintain, and protect valued resources—objects, conditions, personal capacities, and energies—under stress (Hobfoll, 1989; Prapanjaroensin et al., 2017). COR emphasizes loss spirals, whereby an initial loss precipitates further losses, accounting for cumulative well-being decline observed during and after the pandemic; it also allows for gain spirals in which resource presence facilitates subsequent gains, helping sustain engagement (Laschinger et al., 2010). Integrating JD-R and COR yields a nuanced account: specific work resources (autonomy, social support, recognition, development, work–life balance) buffer intensified demands, while temporal dynamics of loss and gain shape engagement trajectories (Saltos-Llerena et al., 2023).

Empirical evidence from healthcare systems in Mexico, Chile, and Greece converges on these mechanisms, underscoring contractual stability as a critical psychosocial resource. In precarious settings—such as those characterized by CAS (Administrative Services Contract) arrangements—organizational cohesion is weakened, with downstream consequences for engagement and quality of care (Bakertzis et al., 2021; Ramírez et al., 2024; Zapata-Herrera & Zapata-Gómez, 2015). This integrated framework thus situates post-pandemic engagement at the intersection of heightened

demands, fluctuating resources, and the accumulative logic of resource dynamics.

Descriptive Statistics and Sample Characteristics

The descriptive analysis revealed important patterns in subjective working conditions across the healthcare institution. Organization-Method: Development showed the lowest mean score (M = 1.84, SD = 0.89), indicating significant concerns about professional development opportunities in the post-pandemic environment. This finding suggests that healthcare workers perceived limited opportunities for growth and skill enhancement, consistent with findings from post-pandemic healthcare systems globally (Wang et al., 2023). In contrast, Organization-Environment: Material presented the highest mean score (M = 3.21, SD = 0.61), suggesting that participants perceived their physical working environment and material resources as relatively adequate. Organization-Environment: Social showed moderate levels (M = 2.95, SD = 0.82), indicating mixed perceptions of social support and interpersonal relationships within the workplace, aligning with reports of strained collegial relationships during periods of high healthcare demand (Hao et al., 2022).

Work engagement dimensions demonstrated varying levels across the sample. Vigor presented the highest mean score (M = 2.37, SD = 0.75), suggesting that despite challenges, healthcare workers maintained relatively high energy levels and persistence. Dedication showed the lowest mean (M = 1.70, SD = 0.65), indicating concerns about emotional connection and involvement with work. This pattern reflects the complex nature of engagement in healthcare settings, where physical stamina may persist while emotional attachment to work becomes compromised under sustained stress (Bakker & Demerouti, 2017). Absorption fell between these extremes (M = 1.91, SD = 0.92), with considerable variability suggesting diverse experiences in work concentration and time perception.

Correlation Analysis and Inter-dimensional Relationships

The correlation matrix revealed significant relationships between various dimensions of subjective working conditions (Table 1). The analysis revealed particularly strong correlations between Organization-Method: Regulation and Organization-Method: Development ($r = 0.86$, $p < 0.01$), suggesting that perceptions of procedural clarity and development opportunities are closely linked. This finding supports the theoretical premise that organizational systems and processes are perceived holistically by employees, as demonstrated in post-pandemic healthcare settings (Yañez et al., 2022). Similarly, Organization-Environment: Social and Material dimensions showed substantial correlation ($r = 0.71$, $p < 0.01$), indicating that social and physical environmental factors are perceived as interconnected elements of the work environment. This finding aligns with COR theory's emphasis on resource interdependence (Hobfoll et al., 2018).

Table 1

Correlation Matrix Between Dimensions of Subjective Working Conditions, Overall Engagement, and Overall SWC Score

Dimensions	1	2	3	4	5	6	Engagement	CLS global
1. Method- Regulation	-							
2. Method- Development	0,86**	-						
3. Environment- Material	0,49**	0,47**	-					
4. Environment- Social	0,68**	0,66**	0,71**	-				
5. Person- Adjustments Organization	0,69**	0,74**	0,37**	0,49**	-			
6. Person-Adaptation Organization	0,18**	0,32**	0,07	0,12*	-0,05	-		

Total Engagement	0,07	0,08	-0,00	0,12*	-0,01	0,13*	-	
CLS global	0,89**	0,89**	0,73**	0,87**	0,72**	0,24**	0,10	-

Note: * p < .05 (*), p < .01 (**). Values near 1 indicate strong positive correlations; values near 0 indicate weak or no correlation.

Structural Model Validation and Resource Pathways

The structural equation model demonstrated adequate fit indices (CFI = 0.91; RMSEA = 0.06; SRMR = 0.04), confirming the effective integration of JD-R and COR frameworks in the post-pandemic healthcare context. These fit indices exceeded conventional standards for acceptable model fit, supporting the theoretical proposition that subjective working conditions influence engagement through resource-mediated pathways, as validated in recent healthcare studies (Ernst et al., 2024).

The validated model revealed that subjective working conditions significantly influenced perceived internal resources (**β** = 0.46, p < 0.001) and external resources (**β** = 0.35, p < 0.01). This finding supports COR theory's premise that favorable working conditions facilitate resource acquisition and conservation (Hobfoll et al., 2018). These resources, in turn, interacted with psychosocial health to differentially impact engagement dimensions. The model revealed particularly strong effects on vigor (**β** = 0.27, p < 0.01) and absorption (**β** = 0.51, p < 0.001), while dedication showed more modest relationships. This pattern suggests that resource availability primarily influences energy levels and concentration capacity, while emotional connection to work may be influenced by additional factors not fully captured in the current model, consistent with recent findings in post-pandemic healthcare environments (Wang et al., 2023).

Employment Variables and Engagement Predictors

Employment variables emerged as critical predictors of engagement levels, revealing significant organizational stratification effects. Permanent staff showed significantly superior engagement levels compared to temporary contract workers, with substantial effect sizes (t = -4.62, p < 0.000). This finding replicates patterns observed in healthcare systems across Chile and Mexico, where contractual stability operates as a crucial psychosocial resource affecting professional commitment and organizational attachment (Thirikwa et al., 2024).

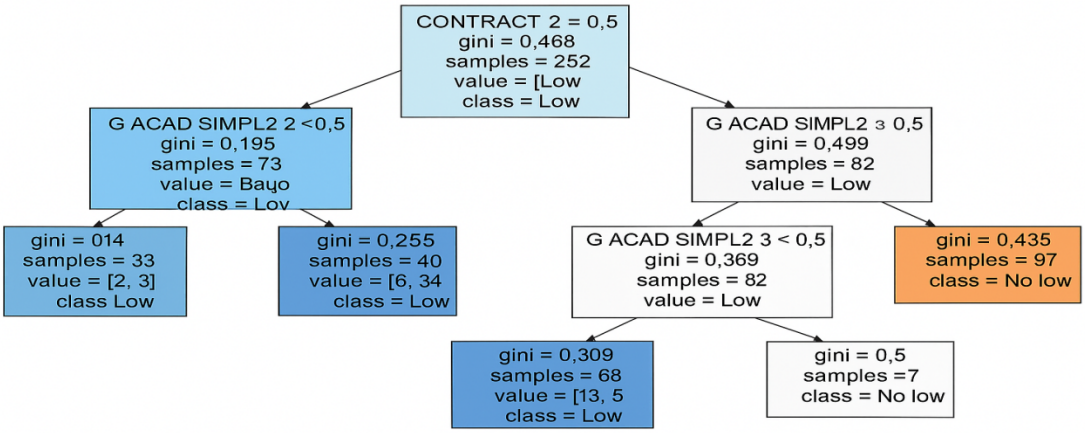
Age group analysis revealed systematic patterns, with younger workers (25-35 years) showing significantly lower engagement levels (M = 1.62, SD = 0.72) compared to all older age groups (F = 10.29, p < 0.000). This finding suggests that career stage and professional development needs significantly influence engagement, with younger workers potentially facing greater challenges in finding meaning and growth opportunities, particularly in post-pandemic healthcare contexts where career advancement opportunities have been limited (Thirikwa et al., 2024).

Professional category analysis demonstrated significant differences across occupational groups, with healthcare professionals showing the highest engagement levels (M = 2.40, SD = 0.70) compared to technical and administrative personnel (F = 11.62, p < 0.000). This hierarchy may reflect differential access to professional resources, recognition, and meaningful work experiences across organizational hierarchies, as documented in recent studies of healthcare workforce dynamics (Ramírez et al., 2024). Interestingly, participants with additional employment beyond their primary healthcare position showed significantly higher engagement levels (M = 2.27, SD = 0.81) compared to those with single employment (M = 2.02, SD = 0.79) (t = -2.64, p < 0.009). This counterintuitive finding suggests that multiple employment may provide additional resources, variety, or financial security that enhance rather than detract from primary job engagement, supporting the resource enrichment hypothesis within COR theory (Hobfoll et al., 2018).

Labor Segmentation and Vulnerability Patterns

The study identified distinct engagement patterns that revealed important workforce segmentation consistent with regional patterns described by Zapata-Herrera in Colombian healthcare systems, where job precariousness erosions organizational cohesion (Trujillo-Pajuelo et al., 2024). Approximately 42.5% of participants were classified as "resilient," demonstrating high engagement levels despite post-pandemic challenges. These individuals typically possessed stable employment contracts, higher educational levels, and access to additional income sources, creating what COR theory describes as resource caravans that facilitate positive positive adaptation (Figure 1).

Figure 1. *Decision Tree for Low Engagement*



Note. The decision tree model classifies participants as having low or not low engagement based on the CART algorithm. The splits are determined by employment contract and academic degree. Gini indicates node impurity. Samples refer to the number of individuals in each node. Value refers to the number of participants classified in each category (low engagement, not low engagement).

In contrast, 26.4% of participants fell into a high vulnerability category, characterized by low engagement, temporary employment status (predominantly CAS contracts), and limited professional development opportunities. This segmentation reflects broader patterns of labor market precariousness in healthcare systems, where contractual instability creates cascading effects on professional commitment and organizational engagement, as documented in recent studies of healthcare employment vulnerability in Latin America (Santos et al., 2020). The remaining participants (31.1%) showed moderate engagement levels with mixed resource profiles, suggesting potential for intervention and improvement with targeted organizational support, consistent with findings from recent healthcare workforce studies (Luna et al., 2023).

Conclusions

The findings reveal a significant relationship between subjective working conditions and engagement in healthcare personnel, although the moderate correlation magnitude ($r = 0.10$, $p < 0.05$) suggests this relationship is mediated by complex organizational and contractual factors. These results align with previous studies conducted in healthcare systems in Mexico and Greece, where similar mediating effects of organizational factors have been documented.

The successful validation of the structural model, with adequate fit indices (CFI = 0.91; RMSEA = 0.06; SRMR = 0.04), confirms the effective integration of JD-R and COR frameworks in understanding post-pandemic healthcare work dynamics. This theoretical integration demonstrates that subjective working

conditions significantly influence perceived resources, with particularly strong effects on internal resources ($\beta = 0.46$, $p < 0.001$) and moderate effects on external resources ($\beta = 0.35$, $p < 0.01$).

Employment variables emerged as critical predictors of engagement, with permanent staff showing significantly superior engagement levels. These findings replicate patterns observed in healthcare systems across Chile and Mexico, where contractual stability operates as a key psychosocial resource (Thirikwa et al., 2024). The identified labor segmentation (42.5% resilient versus 26.4% highly vulnerable) reflects regional patterns where employment precariousness erodes organizational cohesion and professional commitment.

These results extend COR theory by demonstrating that possession of strategic resources (employment stability, additional income sources, educational credentials) facilitates gain spirals even in adverse post-pandemic contexts. The theoretical implication suggests that resource conservation and acquisition processes are not merely defensive but can create positive momentum that enhances engagement and professional development even under challenging circumstances.

The findings demonstrate that subjective working conditions influence healthcare worker engagement through resource-mediated pathways, with employment stability emerging as a critical factor. The integration of JD-R and COR theoretical frameworks provides a comprehensive understanding of how post-pandemic healthcare environments affect worker engagement through resource conservation and acquisition processes.

The identification of distinct vulnerability patterns suggests that organizational interventions should focus on addressing employment security and professional development opportunities rather than solely individual wellness initiatives. Future research should explore longitudinal designs to better understand the temporal dynamics of resource conservation and engagement fluctuations throughout post-pandemic recovery periods.

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Green bond market analysis, issuers conditions and individual investor perception

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Introduction

The capital market offers advantages for issuers not only bank loans, allows the companies to get other types of relation with investors through the bonds market, allowing better cash flow with middle or long terms debts and lower rates than banks, and for investors a better return with current rates that usually are higher than the savings account payment (Boshkoska, 2016).

Studies reflect that issuing bonds require the approval of regulatory institutions that give good reputational image for issuers, also those firms face lower cost of debt and are more profitable, because issuing bonds make them more stable, and provide better capital structure with long terms compromises and lower cost (Sheng, & Montgomery, 2023). For investors, bonds are interesting assets that allow them to have stability and diversify the risks they face in their investment portfolios (Yuthly, 2024). Bonds also "can reward investors with recurring interest payments for lending their money to an issuer for a stated period of time" (E*TRADE, 2025, p. 1).

The green bonds surge as an investment option that finances green projects or assets (Maltais & Nykvist, 2020), "corporate green bonds facilitate the reallocation of investment capital into research and development, effectively mitigating financial constraints on green innovation" (Dong *et al.*, 2024, p.1). Green bonds are fixed-income assets that public or private institutions or companies can issue to finance projects related to the environment and the impact of climate change (Forest Yepez, 2023).

Some benefits according to Tan *et al.* (2022), include reducing information asymmetry between investors and issuers through third-party certification, supporting environmental impact with public policies, and enhancing the positive social image of issuers that back environmentally friendly projects. The return or yield is an important metric for investors "Adding green bonds to a conventional bond portfolio allows reserve managers to improve their reserves risk profile without sacrificing expected return" (Fender *et al.*, 2020, par. 3).

Referring to the green certifications, "The ICMA Green Bond Principles are so-called "voluntary process guidelines" that outline general criteria that most certification schemes follow" (Ehlers, & Packer, 2017). "The Principles are a collection of voluntary frameworks with the stated mission and vision of promoting the role that global debt capital markets can play in financing progress towards environmental and social sustainability" (ICMA, n.d., p.2).

These Green Bond Principles (GBP) share the best practices for issuing bonds with social and environmental purposes to promote transparency and uphold market integrity. (GBP, n.d.). These principles together with Social Bond Principles (SBP), the Sustainability Bond Guidelines (SBG) and the Sustainability-Linked Bond Principles (SLBP) "raise awareness of the importance of environmental and social impact among financial market participants, which ultimately aims to attract more capital to support sustainable development" (ICMA, n.d., p.2).

Figure 1. The Sustainability Bond Guidelines (SBG) from Green Bond Principles 2025.

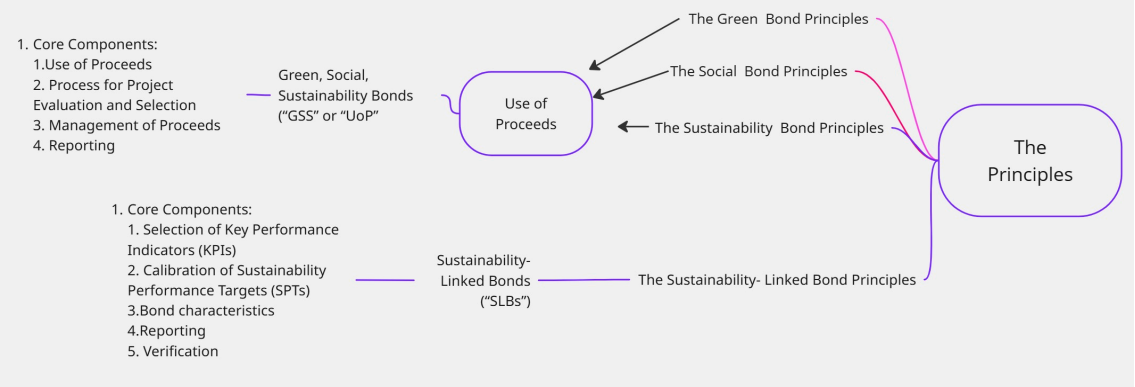


Figure 1 illustrates the integration of these principles, focusing on four core components: From Use of proceeds to Reporting. For Sustainability-Linked Bond Principles, the core components include Selection of Key Performance Indicators (KPIs) to Verification (ICMA, 2025). These components provide market stakeholders with information about where the proceeds from bond issuance are allocated, outline the process for evaluating and selecting projects to support, detail the management of those proceeds, and present reports as best practices for market participants.

Green Bond Issuers

From the issuer side, there are benefits of green bonds, like the reputational impact of the company "Renewable energy projects would earn exceptional public visibility and build a brand reputation. Companies with high social responsibility and environmental consciousness tend to issue green bonds in favor of green development" (Tan *et al.*, 2022, par. 5). And for the verification of the goals of these bonds:

> Looking directly at emissions data provides a simple, transparent and cost-efficient way to verify whether corporates are on track to achieve any stated carbon emission goals. This could complement other efforts to require green bond issuers to publish standardized impact reports, which could include achieved (or expected) carbon reductions (Ehlers *et al.*, 2020, p.32).

Bond issuance in countries like China requires approval form financial regulatory authorities and the successful issuers get a good reputational signal at the market. Also, firms with higher bond debt levels have more profit according to ROA and ROE measurements and face a lower cost of debt (Sheng, & Montgomery, 2023). Third-party certification is a key governance mechanism for green bonds; these certifications help the green bond issuer get better response from market to the announcement of the issues and experience both financial and environmental performance (Flammer, 2020).

The GBP, "provide complementary definitions, standards and taxonomies for determining the environmental sustainability of projects" (GBP, n.d. p. 2), They engage in a collaborative and consultative process with contributions from all members and observers, in accordance with the development of the current Green Bond Market. The GBP "provide issuers with guidance on the key components involved in launching a credible Green Bond" (GBP, n.d., p. 4). Different stakeholders present relevant information for the analysis of green initiatives, some of the sources are restricted or paid information, but there are other free and open sources with pertinent information:

> Climate Bonds is the leading international non-governmental organisation mobilizing global capital for climate action. We drive the growth of the green and sustainable debt market through science-aligned frameworks including our taxonomies and standards, our Certification, our data and insights, and our provision of expert policy and technical advice. (Climate Bonds, n.d., p. 1).

According to Insights from Climate Bonds Data – Issuer Type over the past year, shows the types of issuers and the amounts in USD billions, providing a global over as well as specific insights for developed, emerging, and supranational markets. This data identifies the relevant issuer amounts and types along with the total issues over the seven months covered. The total amount issued in this period is 255.602 USD billion, with more weight issued in September with 26.14%, November 20.19% and October 19.75%. the use of proceeds for the same period into the nine categories presented, the weighted average of the use reflect that the main category is Energy with 33.28%, followed by Buildings and Transport with 20.72% and 19.19%, and the less representative are Adaptation, Information and Communication Technology and Industry with 3.78%, 3.62% and 2.22% respectively.

Green Bond Investors

Green Bonds offer the investor the opportunity to fund green projects, help initiatives to mitigate climate change, and invest in projects that generate environmental benefits (Bachelet *et al.*, 2019). The corporate green bond market growth reflects that the companies can be more competitive integrating shareholders' expectations related to environmental responsibility and sustainability management (Badía *et al.*, 2024). The GBP cited before "aid investors by promoting availability of information necessary to evaluate the environmental impact of their Green Bond investments" (GBP, n.d. p.4).

The increasing interest in these investment assets is reflected (NextGenerationEU, n.d.) In October 2021, the European Commission issued the "NextGenerationEU green bond" with a demand of 11 times for the 15-year bond that exceeded 135 billion euros. The Benefits for investors have been studied in some research like (Martiradonna *et al.*, 2023) where analyzing portfolio allocation strategies they found that the exposition to risk in green portfolios are preferred for investor than non-green portfolios and presented better performance in bear period of market and positive but lower returns in a bull market.

Figure 2. Value of green bonds issued worldwide from 2014 to 2023– Statista

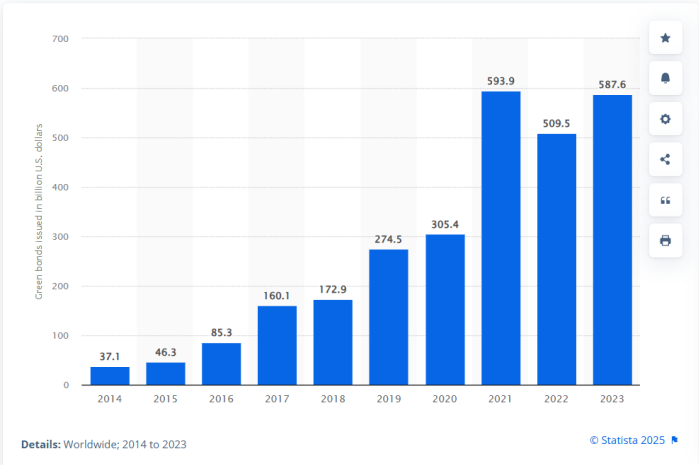


Figure 2 generated by Statista (Green Bonds Issued Worldwide 2014-2023, n.d.) verified the increasing interest of investors for green bond issuance, with an amount issued in USD billion; from 37.1 billion in 2014 to 823% growth till 2020 with levels around 305, and with the las 3 years above 500 billion in 2021-2023, the maximum amount issued in 2021 with 593.9 USD billions.

About profit valuation "The evidence suggests that investors place value on the green label at issuance, even though the post-issuance financial performance of green bonds is comparable with that of conventional bonds" (Ehlers, & Packer, 2017, p. 13). (Bachelet *et al.*, 2019, p. 16) show that "Institutional green bonds display a negative premium and are far more liquid, whereas private green bonds have a positive premium and a much narrower liquidity advantage".

From investors perspective and the available securities options about green bonds, "Bloomberg provides adequate information about corporate bonds, including announcement date, issue amount, coupon, and maturity, that can be missing from the CBI data. Such data are important for our event study analysis" (Tang, & Zhang, 2020, p. 1).

> The global green bond market is represented by two indices: the Bloomberg Barclays MSCI Green Bond Index (BBGB) and the Solactive Green Bond Index (SOLGB). Both are in line with the Climate Bond Taxonomy, a guide to climate-aligned assets and projects developed by the Climate Bonds Initiative, and have been introduced (Martiradonna *et al.*, 2023, p. 2).

Bloomberg Barclays MSCI Green Bond Index (Morgan Stanley Capital International [MSCI], n.d., p.1) "Offers investors an objective and robust measure of the global market for fixed income securities issued to fund projects with direct environmental benefits", It was created in 2014, includes corporate and government-related bonds, rated investment grade by major credit rating agencies, with a fixed minimum issue size and "securities are independently evaluated by MSCI ESG Research along four dimensions to determine whether they should be classified as a green bond" (MSCI, n.d., p. 3).

This index has "6 eligible environmental categories defined by MSCI ESG Research that are: Alternative Energy, Energy Efficiency, Pollution Prevention and Control, Sustainable Water, Green Building and Climate Adaptation" (MSCI, n.d., p. 3). The project selection criteria should be specific to fit into the index and contemplate eligible mechanisms to ring-fence net proceeds.

Solactive Green Bond Index (Solactive, 2025, p. 1) "is a rules-based, market value weighted index engineered to mirror the green bond market. The index is calculated as a Total Return Index denominated in USD". This index is composed of 2.815 entities with different coupons and maturity, the most relevant by weighting are Government of United Kingdom maturity of July 2033, Government of France maturity of June 2039, European Union maturity of February 2050 and Government of Italy maturity of October 2037 with 1.93%, 1.58%, 0.86% and 0.80% respectively, together represent 5.17% of the index.

This research is constructed by combining academic and financial knowledge with open financial sources of information, providing past and current insights into the green bond market. Since the beginning of relevant issuances in 2014, the growth has been evident, reflecting an increasing interest in this type of security. From investor side, it was an analysis about current sources of information to get into the market and the available options for valuation of the green bonds.

The insights from Climate Bonds Data about weighted Average amount per Issuer type; shows a weighted average of the amount issue according to the month relevance and the amount of the issuer, in this period the most representative issuer is the Non- Financial Corporate with 27.10%, followed by Financial Corporate with 24.42% and in the third position Government-Backed Entity with 21.38%, in the other side, the less representative is the Local Government with 2.03% of the amount issued. In this data, the amount issued by Corporates represents 51.52% and for public entities it is 38.13% of the total green bonds.

According to Zhang (2024), In China, public-private energy partnerships show cooperation between government institutions and private initiatives to involve themselves in projects like renewable energy, energy efficiency, and low-carbon infrastructure projects.

Checking the information available from (Insights from Climate Bonds Data, n.d.) in the past 12 months the issuance by country shows the more relevant resources in billions at global level were United States of America 32.8, China 32.7, and Germany 26.3, in the Latin America Region the order of relevance it's in the first place Brazil with 1.7, followed by Chile 0.4, Mexico 0.3 and Colombia with 0.2. The (Global Investments in Clean Tech, n.d.) generated by Statista, indicate the distribution of investments in clean energy in 2025, it is leading by China with 29%, and together with The European Union and United states of America represent 66% of the total investment, the Latin America region and the

Caribbean contribute with 3% of the resources.

About the Bloomberg Barclays MSCI Green Bond Index and Solactive Green Bond Index performance over time, (Bloomberg Barclays MSCI Global Green Bond Index, 2023) presents a chart from 2015 from an initial level of 95, and a bullish trend till the maximum level of 121.91 in 2020 a growth of 28.32% , and two following years going down to 86.94 even below the initial level, that has been recovered to 2023 with 96.09. The Solactive Green Bond Index chart reflects a first level of 993.78 in 2014, a bullish trend until the maximum level of 1158.34 in 2021, with a growth of 16.56%. The trend then shifted to bearish, reaching the minimum level of 778.88 in 2022. The last recorded level was 1020.95 as of 03/07/2025. Both indexes had a 2022 going down but also a post recovery (Solactive, 2025).

Investors analysis

In a specific search of "green bond" in the bar of some open-access sources of information (Bloomberg, n.d.) the following securities with available information; Bloomberg MSCI Global Green Bond Index Total Return Index Value Unhedge (GBGLTRUU:IND), Bloomberg MSCI European Green Bond Issuer Capped EUR Index (I33869:IND), Bloomberg Global Aggregate EUR Green Bond Index Unh EUR (I37379EU:IND), Bloomberg MSCI Global Green Bond Index (I31572:IND) and JPMorgan Common Ground Taxonomy Green Bond Fund (JCGTBFC:CH), it presents 4 index on green bonds, the first 3 in Europe , the other its global level and there is a fifth security from JP Morgan that it's a fund compose by green bonds. But for specific information in this case, you must get a subscription.

The same search for "green bond" by (CNBC, n.d.) presents, VanEck Green Bond ETF (GRNB), iShares USD Green Bond ETF (BGRN), Franklin Municipal Green Bond ETF (FLMB), Nuveen Green Bond Fund (A) (TGROX) and Nuveen Green Bond Fund (I) (TGRKX), in this case there are 3 ETFs, and 2 Funds compose by green bonds. And (Yahoo finance, n.d.) the following, Franklin Sustainable Euro Green Bond UCITS ETF (FLRG.DE), Xtrackers EUR Corporate Green Bond UCITS ETF 1C (XGBE.MI), Amundi Euro Government Green Bond UCITS ETF Acc (ERTH.MI), Amundi Global Aggregate Green Bond UCITS ETF Acc (CLIM.MI), Goldman Sachs Green Bond-X Cap EUR (0P0001IT87.F), and BNP Paribas Green Bond K (0P0001KT7A.F) in this case there are 4 ETFs, and 2 Funds compose by green bonds.

Conclusions

Analyzing green bonds reveals first some limitations regarding the availability of information in this relatively new market. Second, research indicates that the primary issuers are concentrated in major markets such as the United States, China, and the European Union, while participation is lower in regions like Latin America. Issuers include both corporate and public institutions, reflecting a widespread interest in sustainable investment options. This interest is primarily focused on green projects related to energy, buildings, transportation, and improvements in various industries.

Third, for investors the available options are mainly directed toward institutional investors, who have larger resources to participate in the green bond market, primarily through exchange-traded funds (ETFs) and other funds. These funds can later be traded on the secondary market, offering diversification in terms of issues and maturities. However, this structure limits investment options for individual traders, which affects the valuation of each bond and issuer. The performance of these bonds is largely determined by the composition of the index. A significant challenge remains in developing a deeper secondary market that would allow for greater liquidity and more opportunities for broader participation in supporting green initiatives.

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Policies of Representation and the Divine: The image of god through the child's gaze

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Introduction

Who decides how God "looks" when children look at God—and with what ethical–political effects? The issue is anything but minor. From Augustine to the present, the notion of *imago Dei* has served as a foundation for dignity and rights; but it has also, as Hiskes warns, legitimized the exclusion of women, non-white men and, even today, the denial of children's rights (Hiskes, 2023). To speak of the politics of representation is to recognize that images of the divine—visual, narrative, and affective—are not neutral: they are produced in institutions (family, school, church, state, media), circulate in books, icons, and screens, and sediment in children's subjectivities that learn to name, imagine, and relate to "God" in terms of power, belonging, and worth.

Childhood is not a passive receptacle. Pedagogical research with children aged 6–10 shows that they actively construct their image of God from situated experiences: they describe God as a faithful friend, a loving father, or a presence that helps with everyday problems, and that construction varies with school and denominational settings (Heland-Kurzak, 2019). On the strictly visual plane—even in non-Abrahamic contexts—early cultural biases are detectable: Japanese children aged 4–7 tend to choose elderly or white faces as "resembling God," although without a robust gender bias, revealing both the global force of certain stereotypes and local differences in the figuration of the divine (Moriguchi, 2022). These configurations show that the child's gaze is formed at the crossroads of hegemonic iconographies and concrete pedagogies.

Narratives and cultural industries constitute another field of contestation. In recent Greek children's literature, the Olympian gods are rewritten with graphic humor, oscillating between hope and irony: images that bring the sacred closer to the reader while parodying lifestyles and proposing a shared cultural belonging (Volioti, 2021). By contrast, the Soviet campaign of children's atheism in the 1960s instrumentalized books to undermine Christianity; yet an ambivalence surfaced between propaganda and narrative humanism (Naydenova, 2016). In Asia as well, experiences of parental migration (children of overseas Filipino workers) show that—even amid caregiver absence—children elaborate situated theologies that re-signify displacement and bonds (Sarmiento, 2018), and that perceptions of mother and father converse with the image of God (Baring, 2012). These literary and biographical scenes display heterogeneous regimes of representation that institute—or contest—who gets to imagine God and how.

Developmental psychology clarifies another edge of power: it is not "religious affiliation" in the abstract that matters, but which concrete religious contexts traverse a child's life. Among 844 Christian children (ages 7–12), image of God and peer relations in church directly predicted self-esteem; moreover, image of God mediated the influence of family religiosity and ties with church adults (Smith & Crosby, 2017). In other words, what children believe God is for them—loving, close, punitive, or distant—organizes their self-regard and sense of belonging. In adult populations, the evidence converges: childhood trauma and insecure close relationships are associated in adulthood with less benevolent images of God, especially in secular contexts (Kosarkova et al., 2020). Among Muslim children, emotional maltreatment and neglect predict negative divine images, with self-esteem (2021) and self-compassion (2022) as differential mediators: cultivating self-compassion can reorient God's representation toward benevolence, with clinical and pastoral relevance (Kıraç, 2021; 2022).

At the family level—where children learn the languages of God—caregivers' religious climates also matter. Among parents of children with special needs, a benevolent/accepting image of God is consistently associated with lower symptomatology (hostility, interpersonal sensitivity, paranoid ideation, psychoticism, obsessive–compulsive behaviors, and phobic anxiety), suggesting a potential protective factor in high-stress contexts (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c). Although these findings do not refer directly to children, they do delineate the representational atmospheres in which girls and boys grow up and look upon the divine.

This essay draws on that evidence to advance two theses. First, the child's gaze on God is a political terrain where rights, agency, and recognition are at stake: the "politics of representation" of the divine—curricula, iconographies, books, catechesis, state campaigns, family practices—can enable or restrict the theological voice of children (Hiskes, 2023). Second, images of God do not float free: they are embodied in biographies, affects, and relationships; therefore, pedagogy and ministry with a child-rights and intercultural-sensitivity lens must review their visual and narrative repertoires, accompany grief and trauma, and create spaces where girls and boys say and draw God without adult-centric tutelage. What follows weaves these planes—aesthetic, pedagogical, and psychological—to propose criteria and good practices that deactivate exclusionary representations and, instead, promote images of the divine that acknowledge children's dignity, difference, and distinctive voice.

The child's gaze on God

This section presents and develops the first thesis: the child's gaze on God is a political terrain where rights, agency, and recognition are at stake. To claim that there are "politics of representation" of the divine means acknowledging that images—visual, verbal, pedagogical, and affective—do not emerge in a vacuum; they are produced, circulated, and regulated within institutions (family, school, churches, the state, cultural industries) and, in doing so, they enable or restrict children's theological voice. If what children see, hear, draw, and pray about "God" is shaped by curricular decisions, hegemonic iconographies, catechesis, and campaigns, then we are dealing with a field of power with ethical consequences: it is there that negotiations occur over who is recognized as a religious subject, what attributes the divine may have, and how it relates to bodies, ages, and differences.

A normative motivation for this proposal stems from the historical critique of the doctrine of *imago Dei*. In dialogue with the tradition from Augustine onward, Hiskes (2023) recalls that the idea that "human beings were created in the image of God" has been invoked as a basis for dignity and rights; however, dominant interpretations of *imago Dei* also served, for centuries, to exclude women and non-white men from full rights and—more central to our thesis—are still invoked today to deny rights to girls and boys. Taking children's rights seriously, Hiskes argues, requires rereading what it means to reflect the divine image and reorienting the grounding of rights from a child-centered perspective. From this warning follows the guiding question of this essay: how are the images of God that children see and elaborate produced and contested, and what effects do those images have on their agency, recognition, and rights?

The thesis has an interdisciplinary scope and engages three bodies of evidence present in the literature at hand: (a) pedagogical and sociocultural studies on how children construct and visualize God in different settings (Heland-Kurzak, 2019; Moriguchi, 2022; Volioti, 2021; Naydenova, 2016; Sarmiento, 2018; Baring, 2012); (b) developmental psychological research showing that it is not religious affiliation in the abstract that matters, but concrete contexts—family, confessional schooling, relationships with peers and church adults, and the child's own image of God—and how these are associated with outcomes such as self-esteem (Smith & Crosby, 2017); and (c) clinical and public-health evidence linking childhood trauma, attachment styles, and psychosocial variables (self-esteem, self-compassion) with more or less benevolent images of God in adulthood (Kosarkova et al., 2020; Kıraç, 2021; 2022), as well as studies with parents of children with special needs showing that a benevolent/accepting image of God is associated with lower symptomatology (hostility, interpersonal sensitivity, paranoid ideation, psychoticism, obsessive–compulsive behaviors, and phobic anxiety) in high-stress contexts (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c).

On the basis of these pieces, we advance three premises. First, childhood is not a passive receptacle of doctrines: it actively constructs images of God, using resources and negotiating limits set by instituted representational frameworks (Heland-Kurzak, 2019). Second, those images affect self-perception and well-being—for example, by mediating the link between religious socialization and self-esteem (Smith & Crosby, 2017)—and, conversely, trajectories of harm (trauma, insecure attachment) tint the representation of the divine in clinically relevant ways (Kosarkova et al., 2020; Kıraç, 2021; 2022). Third, if iconography and curricula fix traits (e.g., God as elderly, white, male), and if state or ecclesial campaigns are designed without children's participation, matrices of meaning are imposed that can silence, homogenize, or infantilize children's religious voice (Moriguchi, 2022; Naydenova, 2016; Volioti, 2021). Rights are at stake in that tension: participation, non-discrimination, the child's best interests, and freedom of conscience.

We delineate four analytical levels. At the aesthetic–visual level, we interrogate the form images take (age/race/gender attributed to God; codes of proximity/distance). At the pedagogical level, we review curricula and teaching practices that frame how children are taught to imagine God (Heland-Kurzak, 2019). At the community–pastoral level, we analyze relationships with peers and adults in ecclesial and family contexts that mediate the child's experience (Smith & Crosby, 2017; Sarmiento, 2018; Baring, 2012). At the clinical–political level, we consider how trauma histories and attachment styles articulate with representations of the divine and what interventions (e.g., self-compassion) can open spaces for repair (Kosarkova et al., 2020; Kıraç, 2022). This grid makes it possible to identify devices (curricula, iconographies, books, catechesis, campaigns, family practices) and locate mechanisms of enablement/restriction.

Representation, childhood, and the sacred

We use "politics of representation" to refer to the set of decisions (explicit or implicit) through which educational, religious, family, and state institutions define, legitimize, and disseminate ways of seeing, naming, and relating to the divine. In religious education, this includes curricular content, assessment criteria, didactic materials, and iconographies; in the community sphere, liturgical practices and the roles of peers and adults; and in state/media arenas, campaigns and literacy frameworks (religious or atheist). This notion connects the "micro" of children's experience with the "macro" of discursive regimes. For example, the Soviet campaign of children's atheism, analyzed by Naydenova (2016), codified a state repertoire that sought to replace Christian imaginaries with a secular "pantheon"; yet an ambivalence emerged in literature: explicit propaganda coexisted with narratives that, by portraying complex human lives, reintroduced values the campaign itself meant to evacuate. On the other side, recent Greek children's literature "translates" classical gods into contemporary aesthetics that combine hope, satire, and belonging (Volioti, 2021). In both cases, institutions and mediations produce images, but texts are not docile: they contain fissures that children explore creatively.

Heland-Kurzak (2019) shows that girls and boys aged 6–10 do not reproduce doctrines monolithically: they construct images of God that combine what they hear (family, school, church) with what they live (friendships, fears, homework, conflicts). God appears as a friend, a loving father, a help in everyday life; that construction varies across school and denominational settings. Children's agency here is not an anything-goes; it is situated: it arises from available symbolic resources and is negotiated with adult authority. In rights terms, this speaks to the principle of participation: if children can say and draw who God is for them, they will learn theology as a practice of voice rather than mere reception of content. Smith & Crosby (2017) add that a child's image of God is key for self-esteem and belonging: it mediates the influence of family religiosity and ties with church adults; and religious peers directly affect self-esteem. In short, children's theological voice matters for development.

Hiskes (2023) reminds us that *imago Dei* has been invoked both to ground rights and to exclude. Bringing childhood to the center requires revisiting the grammar of recognition: if "being in the image of God" has historically been adult-centric (male, white, autonomous), then children's difference (dependence, vulnerability, playful creativity) challenges the classic metric of dignity. Proposing that the divine image includes children's experience is not ornamental; it reorders who may speak about God and how. Hence any iconography or curriculum that homogenizes God (e.g., male, elderly, white) hierarchizes who can recognize themselves in the divine (Moriguchi, 2022). Insofar as representation places some bodies and ages closer to God than others, it produces religious and symbolic stratification.

The psychology of religion offers a bridge between representations and affective life. In adults, childhood trauma and insecure attachments are associated with less benevolent images of God, especially in secular environments (Kosarkova et al., 2020). Kıraç (2021) showed that emotional maltreatment and neglect predict a negative image of God in Muslim samples, with self-esteem as a partial mediator. Kıraç (2022) extends this with self-compassion as mediator: trauma undermines the capacity to treat oneself with warmth and non-judgment, and that fracture colors the representation of the divine; cultivating self-compassion enables reconfiguring God as merciful, with clinical and pastoral implications. This essay takes up that bridge: politics of representation that enable practices of self-compassion and attachment repair can open children's theological voice and prevent exclusionary or blame-laden tendencies.

Families under stress and representational climates. Evidence with parents of children with special needs underscores that benevolent/accepting images of God are associated with lower hostility, interpersonal sensitivity, paranoid ideation, psychoticism, obsessive–compulsive behaviors, and phobic anxiety (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c). If the home's representational climate—how God is spoken of, how prayer is practiced, what is drawn—is suffused with an image of God as welcoming, it is reasonable to hypothesize that children will have greater resources to imagine God as an ally rather than a judge; conversely, rigid or punitive climates may stifle children's expression. Baring (2012) further links a child's image of God with images of mother and father among Filipino children, suggesting that the domestic relational fabric co-constitutes the representation of the divine. In contexts of migration and caregiver absence, Sarmiento (2018) shows that children re-signify their situation through their own theological narratives, confirming children's agency but also the need to accompany it with structures that legitimize their voice.

In sum, the conceptual framework maintains that: (1) there are regimes of representation with effects of power; (2) children's agency is real but situated; (3) recognition requires revisiting *imago Dei* from the standpoint of childhood; (4) affective life (attachment, trauma, (self-)compassion) mediates representations; and (5) family and community climates are decisive. On this basis, section 3 details the devices that compose the "architecture of image production".

Architecture of image production

We propose an architecture composed of six devices that, in interaction, produce and regulate the image of God available to children. For each one, we specify the mechanism, indicators, and risks/opportunities with respect to children's theological voice.

A curriculum is not a neutral list of topics: it is a grammar that decides what about God merits being taught, how it should be learned, and how what is learned will be validated. There, contents are fixed—divine attributes, names, and metaphors—, methods are chosen—from memorization to inquiry-based work—, and assessments are designed that may reward literal reproduction or open space for creative elaboration. When the course plan prescribes a single correct answer ("God is… period"), the classroom becomes an echo chamber; when, by contrast, it offers open questions, moments to narrate and draw, and times for listening, the classroom becomes a theological workshop where girls and boys put their experience of the sacred into words and images. Pedagogical evidence suggests that this transition is real: at early ages, children often repeat "closed" formulas, but around ages 9–10 they reinterpret what is taught in light of their everyday world—their fears, games, and relationships—if the instructional environment provides the scaffolding to do so (Heland-Kurzak, 2019). A curriculum that rewards only memory hinders that passage; one that honors inquiry and expression accelerates it. To keep focus, it is useful to look at "voice indicators": how much practice of self-expression—stories, drawings, invented metaphors—versus copy exercises; how much diversity of metaphors—whether everything rests solely on "King/Father" or also includes "Friend," "Fellow Traveler," "Physician," "Refuge"; and how assessment is conducted—whether formative assessment returns criteria and opens conversation. This shift is not merely didactic; in middle childhood, the image of God that the child is developing and relationships with peers in the religious community directly predict self-esteem, and that personal image also mediates the influence of family religiosity and ties with church adults (Smith & Crosby, 2017). The risk, by contrast, consists in canonizing a single image—often that of an exclusively male, elderly God—that shuts down symbolic exploration; the opportunity lies in co-designing activities and assessment tools with children themselves, so that their stories and drawings are recognized as theological knowledge and not merely as an "art activity" (Heland-Kurzak, 2019; Smith & Crosby, 2017).

Images teach even when no one speaks. A holy card on the wall, a poster in the classroom, a figure in a catechism book: all of these devices educate the gaze and sediment who "looks like" God. Comparative research shows how early this visual learning occurs: Japanese children aged 4–7 tend to choose elderly and, to a lesser extent, white faces when asked which one "most resembles" God, and they do so without a robust gender bias, even in a non-Abrahamic cultural context (Moriguchi, 2022). The scene is telling: global conventions—the elderly, white God—are internalized very early and beyond explicit theology. If the iconography we offer is monochrome, the learning will be as well. That is why it matters to measure what we show: diversity of ages, phenotypes, and genders in representations; distances—whether the divine appears far away, on a throne and in clouds, or close, in everyday scenes; and relationship to the community—whether it is presented in isolation or "in the midst" of diverse children. A rigid iconography fixes symbolic hierarchies by insinuating that certain bodies, ages, or skin tones are closer to God than others. But an inclusive curatorship—one that pluralizes visual metaphors and puts tradition and everyday life in dialogue—enables multiple identifications and fosters critical discussion. Contemporary Greek children's literature offers an example of this fruitful dislocation: it rewrites the gods with humor, makes the boundary between the sacred and the familiar porous, and connects with a shared cultural belonging without closing down meaning (Volioti, 2021). When classroom walls and book pages are populated by such plurality, children learn to see differently (Moriguchi, 2022; Volioti, 2021).

Stories do not merely transmit data: they organize meaning. In the ecosystem of childhood, books are privileged frameworks for imagining and feeling the divine. In Greece, recent collections present the

Olympian gods with humor and everydayness, bringing the sacred closer to the child reader and proposing a belonging that dialogues with cultural memory; those same images contain layers of irony that parody lifestyles and open fissures for critical reading (Volioti, 2021). There is, however, a cautionary tale: in the Soviet Union of the 1960s, children's books conveyed programmatic atheism as part of a state campaign; even so, a double discourse appeared within that machinery, for explicit propaganda coexisted with narratives capable of safeguarding ambivalences and human values that the slogan could not absorb (Naydenova, 2016). Recognizing which books enable voice entails attending to tone—devotional, ironic, critical—; to children's agency in the plot—girls and boys who challenge, doubt, question—; to moral complexity—conflicts without Manichaeism—; and to the bridges they offer for the reader to rewrite—questions at the end, invitations to draw, prompts to tell "what God is like for me." In contexts of migration and caregiver absence, for example, Filipino girls and boys elaborate situated theologies that re-signify displacement when stories open space for them to speak (Sarmiento, 2018); and in Manila public schools, the image of God closely dialogues with images of mother and father, confirming that the book not only entertains: it catalyzes family conversations (Baring, 2012). The danger is propaganda—religious or atheist—that replaces the question with a slogan; the opportunity lies in books that invite children to narrate God from their own experience (Volioti, 2021; Naydenova, 2016; Sarmiento, 2018; Baring, 2012).

No one believes alone: community organizes bonds, and those bonds shape the experience of God. In middle childhood, relationships with peers within the religious community and the child's own image of God directly predict self-esteem; moreover, that personal image mediates the influence of family practices and ties with church adults (Smith & Crosby, 2017). It is not enough, then, merely to "attend" catechesis: what is decisive is how one participates, with whom, and whether there is room for children's voices to recount their experience of the sacred. Catechesis that enables voice is recognizable by the presence of spaces for speech—brief testimonies, Q&A circles, moments when children share their images and doubts—, by the quality of adult mentoring—adults who listen, not merely instruct—, and by the centrality of peers—choirs, groups, projects in which children lead activities for other children. Where such practices exist, the community does not "apply" content onto children: it learns with them, and that transforms both the image of God and self-esteem. The risk, by contrast, is adult-centric catechesis where the child only receives, questions are perceived as interruptions, and children's metaphors as errors. The opportunity is to build communities that listen to and learn from children's theology, recognizing childhood as a full locus of spiritual experience (Smith & Crosby, 2017).

Beyond classrooms and parishes, public policy and the media set the grammars in which a society speaks—or falls silent—about religion. Well-designed literacy can promote respect and pluralism; clumsy efforts can impose uniformities or demonize difference. The Soviet experience functions as a warning: "atheist pedagogy" sought to reconfigure children's imaginaries through literature and other devices; its trace revealed a persistent ambivalence, because strong regulation can inhibit creativity but not erase it, and state discourse never fully controls what children imagine when they read (Naydenova, 2016). Hence good intervention indicators are about orientation: a rights perspective—non-discrimination, freedom of conscience—, promotion of the plurality of beliefs, and above all the creation of spaces for child production—story and art contests, fairs where children present their stories, platforms to publish drawings and metaphors of God. The risk is to repeat the propagandistic gesture that infantilizes the audience; the opportunity, policies that recognize children as authors and a media ecosystem that listens and teaches how to read both religious and anti-religious images critically (Naydenova, 2016).

The theology of many children begins at the table and at bedtime: in how one prays, in what is said (or left unsaid) about God, in who offers comfort when something hurts. Home is, in that sense, the first theological workshop. Studies in Manila public schools show that a child's image of God converses with their image of mother and father; the divine and the parental mirror and correct one another in

the child's imagination (Baring, 2012). When migration separates caregivers, that conversation does not stop: girls and boys elaborate situated theologies that re-signify absence and find ways to read God in the midst of displacement when their speech is legitimized (Sarmiento, 2018). In households under high stress, such as those raising children with special needs, that spiritual climate has measurable correlates: a benevolent, accepting image of God among caregivers is associated with lower hostility and interpersonal sensitivity, less paranoid ideation, lower psychoticism, and fewer obsessive–compulsive and phobic-anxiety symptoms (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c). This is not to extrapolate these associations to children without caution, but to note that the home's representational environment—how God is named, what tone God's presence takes—shapes the affects that are breathed: a welcoming God makes a climate of trust more likely; a punitive God, one of guilt and fear. Looking at family life through concrete indicators helps: frequency and quality of religious dialogue at home, parenting styles—support and warmth versus punitive control—and rituals led by children—shared reading, improvised prayer, a drawing posted on the wall. The danger lies in sticking to punitive scripts that project guilt onto the divine and stifle children's speech; the opportunity, in dialogical practices that nurture self-compassion and strengthen secure-attachment bonds, knowing that in adulthood such self-compassion positively mediates the reconfiguration of a more merciful image of God and is therefore a desirable formative horizon from childhood onward (Kıraç, 2022). When the home becomes a place where God can be named without fear, children's theological voice finally finds its own timbre.

Mechanisms for enabling vs. restricting children's voice

Children's theological voice does not appear by spontaneous generation: it is enabled or restricted according to the devices that surround it. When the classroom, liturgy, and community organize their daily life as spaces of dialogue, the words of girls and boys find channels. A curriculum that includes open questions and writing and drawing as legitimate ways of thinking about God turns class into a workshop where experience counts. Formative assessment acts like a traffic signal: instead of penalizing imperfect memory, it returns criteria, invites revision, and values original interpretations. There, children not only speak; they learn to listen to themselves, to weave metaphors with lived experience, and to risk hypotheses they then test with peers and the adults who accompany them (Heland-Kurzak, 2019). The same principle unfolds in the community: if catechesis incorporates moments of brief testimony, question rounds, and spaces where children present what they have written or drawn, voice becomes a sustained practice rather than a sporadic accident.

Visual language pushes in the same direction when curatorship is carefully tended. Images teach without words and, for that reason, iconography that diversifies ages, phenotypes, and metaphors of the divine broadens the field of identification. Showing "God with us" in everyday scenes—care, play, school—brings the sacred closer to biography and legitimizes children's own narratives (Volioti, 2021). That Japanese children aged 4–7 "age" and "whiten" God, even without a robust gender bias, reveals how early certain global conventions are learned (Moriguchi, 2022). The good news is that this plasticity also allows us to educate the gaze: a classroom wall that alternates scenes of transcendence and proximity, symbols and embodied metaphors, invites thinking along multiple lines and prevents confusing an aesthetic code with the essence of the divine.

None of this thrives if relationships fall out of focus. Peer networks and sensitive mentoring make tangible the right to have a voice that is heard. In communities where choirs, groups, and games are not appendices but engines, children's self-esteem grows and the image of God operates as a positive mediator of well-being: what a child believes God is for them articulates the effect of family practices and ties with church adults, while relationships with peers directly predict self-regard (Smith & Crosby, 2017). To accompany is to listen, not just instruct: adults who model questions, who confess their doubts, and who open space for reply teach that faith is also a conversation.

A fourth enabling vector is psycho-spiritual care. Integrating self-compassion into religious education—languages of kindness toward oneself, recognition of shared suffering, practices of calm attention—is not a therapeutic fad; it is a pedagogy of the image of God. In samples of Muslim youth, self-compassion partially mediates the link between childhood trauma and a negative image of the divine; cultivating it favors reimagining God as merciful (Kıraç, 2022). Transposed to the classroom or catechesis, this means offering exercises in self-kindness when a child makes a mistake, naming pain without either melodrama or denial, and building routines of trust that repair attachments. In the family, especially under stress, sustaining a benevolent image of God helps reduce hostile climates and, with that, keeps open the possibility of speaking without fear (Bonab & Koohsar, 2011c).

The last link on the enabling side is public policy with a rights-based approach. When campaigns and programs recognize girls and boys as authors—story and art contests about the sacred, school interreligious dialogue forums, platforms where they can publish their drawings—the message ceases to descend in slogan form and becomes a circulating social conversation. Pluralism is not proclaimed; it is practiced by opening windows onto symbolic diversity and teaching how to read both religious and anti-religious imagery critically (Naydenova, 2016). The key is to avoid instrumentalization: it is not about "using" children's voices to validate agendas, but about protecting their right to speak and be heard.

On the other pan of the scale, restriction mechanisms accumulate. A one-way curriculum and "single-answer" assessments school theology as memorization. When there is only one correct answer—for example, God only as "King/Father"—symbolic exploration is silenced and metaphors born of experience are delegitimized (Heland-Kurzak, 2019). The classroom becomes an echo chamber in which creativity is perceived as noise. The harm is not minor: without rehearsal in speaking, voice atrophies.

To that silencing we must add the force of rigid visual stereotypes. Iconography that naturalizes God as elderly, white, and male privileges some bodies and ages and discourages others from seeing themselves reflected in the divine (Moriguchi, 2022). Symbolic closure operates by repetition: the more homogeneous the image, the harder it is to imagine alternatives. Representation ceases to be an invitation and becomes a border. One learns, without anyone saying so, who can "resemble" God and who is left outside the frame.

Adult-centric catechesis also restricts voice. Communities where adults speak and children listen perpetuate silences. If, in addition, transmission relies almost exclusively on guilt or fear, the divine is drawn as a punitive figure and questioning loses its place. The result is a vicious circle: the less questioning is allowed, the more fragile children's faith becomes and the more dependent it is on adult approval.

In the public sphere, propaganda—religious or atheist—without critical space acts as a gag. By substituting narratives with slogans, both dogmatic catechesis and anti-religious campaigns reduce the complexity of belief to catchphrases that admit no nuance. History shows, however, that discourse is never fully controlled: even in contexts of strong regulation, children's literature revealed ambivalences and irreducible human values (Naydenova, 2016). That does not neutralize the harm of restriction, but it does remind us that children's voices seek out cracks. Good policy learns from that lesson to widen them rather than seal them.

Finally, punitive family practices or sustained silences discourage expression. Homes where God is associated primarily with punishment, or where the sacred is not spoken of, generate climates in which speaking feels risky or superfluous. Evidence with caregivers of children with special needs is clear: a benevolent image of God among parents is associated with better mental health—less hostility and interpersonal sensitivity, lower paranoid ideation and psychoticism, fewer obsessive–compulsive and phobic-anxiety symptoms (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011). It is reasonable

to suppose that such kinder climates also open up the possibility for children to express themselves with confidence.

These mechanisms rarely act in isolation: they interweave, amplify, or neutralize one another. An inclusive curriculum can be overshadowed by standardized iconographies; a dialogical community can potentiate what the home opens; a campaign that recognizes children's authorship can undo school routines of silence. Hence the need for an integrative framework that identifies systemic intervention points and coordinates efforts across school, community, home, and the public sphere. Only then will children's theological voice cease to depend on the luck of a good teacher or a particularly sensitive family and become a guaranteed right in the very architecture of our practices (Heland-Kurzak, 2019; Moriguchi, 2022; Volioti, 2021; Smith & Crosby, 2017; Kıraç, 2022; Bonab & Koohsar, 2011a; Koohsar & Bonab, 2011; Naydenova, 2016).

Integrative model (Logic of effects)

We propose an open-system model that connects inputs (representation policies/devices) with mediation processes (relational and psycho-affective), outputs (image of God), and outcomes (self-esteem, coping, recognition), incorporating feedback loops and intervention points.

The model begins from the institutional and cultural inputs that surround childhood and, without saying so explicitly, shape what can be said about God. Curricula determine contents, methods, and assessments; if they privilege memorization and "single-answer" formats, they turn the class into an echo chamber, whereas if they open space for questions, narratives, and formative assessment, they legitimize children's self-expression and peer listening (Heland-Kurzak, 2019). Iconographies, for their part, educate the gaze: repeated standardization—God as elderly, white, distant—teaches symbolic hierarchies, whereas diversity of ages, phenotypes, and genders, along with scenes of proximity, enables other identifications and critical conversations (Moriguchi, 2022). Children's books organize meaning: their tones—devotional, ironic, critical—the room they grant to children's agency, and the moral complexity of their plots can either accompany or discipline religious imagination; literature that rewrites the sacred with humor and everydayness, without abandoning irony, brings the divine closer to the reader's world and sustains discussion (Volioti, 2021). In community life, catechesis that creates spaces for speech and distributes roles among peers and adults ceases to be mere transmission and becomes a shared workshop; there, belonging is learned by practicing voice. The public sphere, with its campaigns and media, adds another layer: a rights- and pluralism-oriented approach that recognizes children's authorship multiplies windows for speech, whereas one-way crusades—religious or anti-religious—tend to instrumentalize children and impoverish dialogue (Naydenova, 2016). Finally, family practices—everyday dialogue, parenting styles, rituals led by children—are the laboratory where theology becomes habit: in that microclimate what was learned at school, in the community, and in books is either aligned or set askew.

Between inputs and the final representation, relational mediations operate. Peer relationships nourish affection and belonging; they are not decorative, since they directly impact children's self-esteem and predispose forms of belief that coalesce into more or less hospitable images of God (Smith & Crosby, 2017). The adult network—family and church—models languages for speaking about God and offers keys for reading one's own experience; its influence on self-esteem is not linear but works to a large extent through the child's image of God as it is being constructed (Smith & Crosby, 2017). Above each tie, coherence—or dissonance—across home, school, and community tips the scales: a welcoming home plus inclusive iconography reinforces a divine figure that is close and compassionate; a punitive home combined with a memory-driven curriculum pushes toward shutting down speech and hardening the image.

Alongside these relational mediations, psycho-affective mediations tint the color of the divine. Early attachment, made of availability and care, shapes relational expectations that are often transferred to

the relationship with God: basic trust facilitates imagining closeness; insecurity, distance and ambivalence (Kosarkova et al., 2020). When trauma intervenes—maltreatment, neglect—the balance tilts toward representations of God as cold, unjust, or distant; however, that effect is modifiable and does not determine fate (Kıraç, 2021; 2022). In that fine-tuning, self-esteem mediates part of the trauma's impact on the image of God (Kıraç, 2021), while self-compassion—which can indeed be cultivated pedagogically—partially mediates and opens a vector for intervention: learning to treat oneself benevolently prepares the ground for recognizing the divine as compassionate (Kıraç, 2022).

The result of this interaction between inputs and mediations is the image of God that inhabits the child's mind and body. This is not an abstract definition but a lived relational schema positioned along a continuum from benevolent/accepting/close to punitive/distant/controlling (Heland-Kurzak, 2019). That figure organizes expectations, regulates affects, and becomes a moral resource with which children act: depending on how they imagine God, a child feels more or less enabled to speak, ask for help, offer care, or say "no."

The outcomes of this process are observable in development and recognition. In childhood, a benevolent image of God, accompanied by peer networks, is associated with higher self-esteem and better coping strategies (Smith & Crosby, 2017). In adults, that same benevolent register is linked to better mental health among caregivers under high stress—lower hostility and interpersonal sensitivity, less paranoid ideation and psychoticism, fewer obsessive–compulsive and phobic-anxiety symptoms—suggesting that the home's spiritual climates affect well-being and, plausibly, the conditions for children's voices to flourish (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011). In terms of recognition, inclusive policies and iconographies broaden who can see themselves in the divine, and devices that legitimize children's authorship—books, curricula, liturgies—consolidate agency. Normatively, rereading *imago Dei* from childhood strengthens a rights framework for girls and boys in public theology, shifting dignity from an adult-centric ideal to concrete practices where children are subjects who speak (Hiskes, 2023).

This system is not static; it is fed by feedback loops. When children inhabit a welcoming image of God, self-compassion and more secure attachment tend to grow, and that growth, in turn, reinforces the benevolent representation, creating spirals of well-being that stabilize kind family and community climates (Kıraç, 2022). Conversely, unrepaired trauma combined with punitive devices—closed curricula, standardized iconographies, adult-centric catechesis—consolidates controlling images that foster guilt and fear, shut down questioning, and with it, voice.

Against this map, the levers for intervention are clear. In curriculum design, it is advisable to include guided inquiry, storytelling, and assessments that legitimize children's expression and provide criteria for improvement, not merely grades (Heland-Kurzak, 2019). In iconographic curatorship, explicit criteria of diversity—age, phenotype, gender—and visual proximity help deactivate learned hierarchies (Moriguchi, 2022). In community architecture, creating spaces for children's speech and leading roles in liturgy, while strengthening peer bonds, aligns belonging with voice (Smith & Crosby, 2017). In psycho-spiritual care, integrating practices of self-compassion and attachment-repair strategies into catechesis and ministry offers concrete tools to reconfigure the divine without denying the wound (Kıraç, 2022). In public policy and media, rights-based campaigns that recognize children as authors—not as objects of indoctrination—together with caution to avoid one-way propaganda, sustain pluralism as practice rather than slogan (Naydenova, 2016). In family accompaniment, promoting regular dialogues and rituals led by children, as well as sustaining a benevolent image of God in stressed households, creates atmospheres conducive to speaking and listening (Koohsar & Bonab, 2011).

Integrated in this way, the model confirms the underlying thesis: the child's gaze on God is a political terrain because institutional and cultural inputs, as they pass through relational and affective mediations, configure the image of God as a matrix of agency and recognition. The good news is that

this terrain can be cultivated: there are concrete levers within reach of schools, communities, families, media, and states to enable children's theological voice and honor their dignity. As Hiskes (2023) reminds us, this recognition cannot remain at the level of doctrinal abstraction; it must be embodied in practices where children think, tell, and draw God—and are taken seriously when they do so.

Images of God Do Not Float

The thesis guiding this part of the essay holds that images of God do not float above life: they are embodied in biographies, affects, and relationships, and therefore any pedagogy and ministry with a child-rights and intercultural sensitivity lens must review its visual and narrative repertoires, accompany grief and trauma, and create spaces where girls and boys say and draw God without adult-centric tutelage. The ethical justification rests on a critical reading of *imago Dei*: if that language has served, historically, to ground human dignity, it has also been instrumentalized to exclude and, even today, to relativize children's rights. Recognizing children as rights-bearing subjects entails, as Hiskes warns, rereading the "image of God" from their perspective and ceasing to treat them as objects of symbolic tutelage (Hiskes, 2023). This thesis is therefore not a mere pastoral add-on: it redefines how educational institutions, religious communities, families, and public policies relate to children's theological imagination.

From here we propose three guiding questions. First: In what concrete ways are images of God embodied in children's biographies and affects? The literature shows that children do not merely "repeat" content: they construct relational images of God, and that construction depends on the school and denominational environment, on how teaching is conducted, and on what spaces exist for narrating and drawing (Heland-Kurzak, 2019). Moreover, in middle childhood, the image of God each child develops mediates the influence of family religiosity and ties with church adults, while relationships with peers directly predict self-esteem (Smith & Crosby, 2017). This suggests that the image of God is a relational schema that organizes belonging and recognition, not a free-floating concept. Second: Which visual and narrative repertoires (iconographies, books, catechesis) support or harm that embodiment? We know that, even in non-Abrahamic contexts, young children tend to "age" and "whiten" God—a sign of the power of global conventions—but without a robust gender bias (Moriguchi, 2022); that children's literature can bring the sacred closer through humor and everydayness (Volioti, 2021); and that state campaigns of atheism, even when they sought to discipline imagination, allowed ambivalences and human values to slip through narratives (Naydenova, 2016). Third: Which pedagogical and pastoral practices heal wounds and empower children's voice? Clinical and public-health evidence indicates that childhood trauma and insecure attachments are associated, in adulthood, with negative images of God (distant, cold, unjust), with self-esteem and self-compassion as partial and cultivable mediators (Kosarkova et al., 2020; Kıraç, 2021; 2022). In turn, in highly stressed families, a benevolent image of God among caregivers is related to better mental health, shaping kinder climates for children's expression (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c). These data do not substitute for listening directly to children, but they do help set priorities.

Embodiment of the divine in children's experience

Speaking of the embodiment of images is not a pious metaphor; it is a psychological, pedagogical, and political thesis. The image of God operates as a lived relational schema: a mode of expectation and meaning that children rehearse in interaction with their environments and that, over time, stabilizes as a moral resource. Interviews with children in Catholic, Orthodox, and Protestant contexts reveal that, from early on, girls and boys describe God as a friend, a loving father, a companion who helps with everyday problems; and that this way of speaking depends on the school and denominational environment (Heland-Kurzak, 2019). It is not a free-floating concept: it is a grammar that touches life and changes with it.

From developmental and psychology-of-religion perspectives, two families of processes explain this embodiment. On the one hand, relational mediations. In middle childhood, self-esteem is directly affected by peer relationships within the religious community; moreover, a child's image of God mediates the effect of family religiosity and ties with church adults (Smith & Crosby, 2017). Here, the representation of the divine functions as a filter that turns socialization into self-valuation: if "God-with-me" feels close and benevolent, family and ecclesial practices tend to reinforce belonging; if it feels distant or punitive, the very same repertoire can become a source of strain. On the other hand, psycho-affective mediations connect early history and personal theology. In adult populations, childhood trauma and problematic attachments are associated with less positive images of God—less love, less forgiveness, less presence—especially in secular contexts (Kosarkova et al., 2020). In Muslim samples, different subtypes of maltreatment predict more negative divine images, with self-esteem as a partial mediator (Kıraç, 2021); and, crucially, self-compassion—an attitude of warmth and non-judgment toward oneself in difficulty—partially mediates the relationship between trauma and the representation of God, opening a formative lever (Kıraç, 2022). The image of God, thus, is malleable: it changes as relational and affective conditions change.

The notion of politics of representation helps connect these levels. Not only families and communities but also curricula, iconographies, and books fix "what can be imagined" about the divine. At very early ages, Japanese children tend to "age" and "whiten" God, a sign that certain global visual codes are learned as "normal" even outside Abrahamic traditions, and that gender bias may be more culturally labile (Moriguchi, 2022). At the same time, children's literature can rewrite the sacred with humor and everydayness, opening belongings and allowing irony; or, if it becomes propaganda (religious or atheist), it can attempt to standardize imagination—although history shows its ambivalence and the margin of resistance in narratives (Volioti, 2021; Naydenova, 2016). The conceptual conclusion is that images of God are produced within a network of devices and relationships; understanding their embodiment requires reading both planes.

A child-rights approach provides the normative dimension. If *imago Dei* was used to ground dignity, it also served to subordinate and silence; taking children's rights seriously requires recognizing them as authors of religious discourse and adhering to principles of participation, non-discrimination, and the best interests of the child (Hiskes, 2023). In practical terms, this means designing curricula and liturgies where children's voice is not an add-on but a condition of legitimacy; curating iconographies that do not reproduce bodily and racial hierarchies (Moriguchi, 2022); and promoting practices of self-compassion and attachment repair as intrinsic to spiritual care (Kıraç, 2022; Kosarkova et al., 2020).

Intercultural sensitivity completes the frame. There is no single valid way to figure the divine. Hegemonic iconography (an old, white God) coexists with local rewritings—such as Greek children's literature that renders the gods close and parodic (Volioti, 2021); with state attempts to erase the sacred through atheist literacy (Naydenova, 2016); and with everyday theologies by children growing up with migrant parents, capable of remaking the presence/absence of God in their stories (Sarmiento, 2018), or by children whose representation of the divine dialogues with their images of mother and father (Baring, 2012). Interculturality, in this frame, is not adding "images from everywhere," but translating repertoires with biographies and wounds in view, avoiding exoticization and aiming for plausible identifications.

In sum, the conceptual framework articulates: (a) image of God as an embodied relational schema (Heland-Kurzak, 2019; Smith & Crosby, 2017); (b) relational and psycho-affective mediations that shape it (Kosarkova et al., 2020; Kıraç, 2021; 2022); (c) politics of representation that widen or narrow what is imaginable (Moriguchi, 2022; Volioti, 2021; Naydenova, 2016); and (d) a rights horizon that demands participation and care (Hiskes, 2023). Upon this scaffolding rests the state of the art and the action proposals.

Guiding principles for a child-rights-based pedagogy and ministry

The first principle is real participation: children are not "recipients" but authors of religious discourse. In classroom and catechesis, this translates into methodologies that invite questioning, writing, and drawing, with formative assessment that returns qualitative criteria instead of "correcting" definitions (Heland-Kurzak, 2019). Real participation also means roles for children in liturgies and community spaces, and leadership in projects where peers accompany peers (Smith & Crosby, 2017).

The second principle is non-discrimination and recognition. Iconography and materials must diversify ages, phenotypes, and genders in representing the divine; the goal is not relativism but symbolic hospitality that avoids implicit hierarchies like "God = elderly white man," a bias detected at very early ages (Moriguchi, 2022). Recognition also entails including scenes of proximity where the sacred appears in everyday life—care, play, school—and not only on thrones and clouds (Volioti, 2021).

The third principle is the child's best interests, which in spiritual key translates into psycho-affective care: detecting signs of trauma or grief, respecting pacing, instituting protocols for containment and referral when necessary, and integrating practices of self-compassion and attachment repair into educational and pastoral routines. Evidence supports that self-compassion mediates part of trauma's harm on the image of God (Kıraç, 2022), and that secure early relationships facilitate imagining a God who is close (Kosarkova et al., 2020).

The fourth principle is critical interculturality. In contexts where local and global repertoires coexist, the task is not to collect "diverse" images but to translate with care. Greek literature illustrates how humor can rewrite the sacred without emptying it (Volioti, 2021); the Soviet experience warns against univocal campaigns that stifle imagination (Naydenova, 2016); studies in the Philippines show theologies of absence/presence in contexts of migration (Sarmiento, 2018) and dialogue between a child's image of God and images of mother/father (Baring, 2012). Critical interculturality thus means dialoguing repertoires and situating practices.

The fifth principle is formative assessment oriented to voice. The measurement of learning must count stories, drawings, and metaphors as legitimate evidence of religious understanding; use rubrics co-designed with children; include self- and peer assessment; and track indicators of leadership and participation (Smith & Crosby, 2017). Assessing in this way is not merely "being kinder"; it aligns evaluation with the goal of embodying learning in experiences and relationships.

Finally, a transversal principle: the ethics of care and safeguarding. Every invitation to "say and draw God" must be accompanied by clear rules of confidentiality (age-appropriate), prevention of re-traumatization, and training of adults in non-directive listening and careful feedback. Voice matters as much as how we listen to it. Taken together, these principles translate the rights horizon Hiskes (2023) calls for into verifiable practices.

Audit and redesign of visual and narrative repertoires

The audit begins by making visible what we often take for granted. For iconographies, compile an inventory of images used in classrooms, catechesis, and community spaces, coding age, phenotype, and gender of divine figures and recording distance/proximity (throne/everyday scene). The aim is to detect standardizations—e.g., a predominance of an elderly, white God—that children internalize early (Moriguchi, 2022). For books, analyze tone (devotional, ironic, critical), children's agency in plots, and moral complexity (ambivalence vs. Manichaeism), distinguishing works that invite narration from those that propagate slogans (Volioti, 2021; Naydenova, 2016). For curricula, calculate the proportion between self-expression activities (stories, drawings, metaphors) and reproduction exercises, as well as the presence of multiple metaphors for God (Heland-Kurzak, 2019).

With the diagnosis in hand, proceed to redesign. For iconographies, propose inclusive curatorships co-created with children: galleries that alternate traditional symbols with contemporary metaphors, scenes of proximity, and explicit bodily diversity. Develop guides to alternative metaphors—"Friend," "Refuge," "Physician," "Fellow Traveler"—linked to children's experiences (school, play, care). For books, prioritize works that open questions and recognize the reader's voice, and produce paratexts (reading guides) that invite rewritings, everyday-theology journals, and "God maps" across the week. For curricula, install inquiry sequences with formative assessment and rubrics that weigh originality, clarity of metaphors, connection with experience, and respect for diversity (Heland-Kurzak, 2019).

Redesign requires adult formation. Teachers and catechists need tools to facilitate dialogues (not control them), contain emotions when grief/trauma emerges, and give feedback that amplifies voice without imposing it. This formation can be articulated with workshops on self-compassion and attachment—to recognize signs and know when to refer (Kıraç, 2022; Kosarkova et al., 2020). Alongside this, propose classroom museums and school anthologies that exhibit children's theological stories and drawings, with consent and protective frameworks. This is not decoration: it is a policy of recognition.

To sustain the process, define monitoring indicators: % of expression activities; iconographic diversity (a simple index by age/phenotype/gender); number of opportunities for children's leadership per term; systematic use of formative assessment. For outcomes, track changes in the image of God (age-adapted scales), in self-esteem (expecting mediating effects of image of God and peers; Smith & Crosby, 2017), and qualitative reports on family/community climate. This audit–redesign–evaluation cycle turns the thesis into everyday management.

Accompanying grief and trauma: Applied psycho-spiritual care

To accompany is not to "psychologize" faith; it is to recognize that images of God are colored by affective history. Evidence indicates that experiences of maltreatment and neglect predispose one to see God as distant, cold, or unjust; however, this effect is modulable and does not fix destiny (Kıraç, 2021; 2022). In secular environments, moreover, these associations may be more pronounced (Kosarkova et al., 2020). Hence responsible pedagogy and ministry integrate care protocols: clear guidelines for opening difficult conversations, times for listening without pressure to respond, age-appropriate confidentiality safeguards, and referral to professionals when classroom or catechetical competencies are exceeded.

Self-compassion is incorporated as a transversal practice. It is not a therapeutic ornament: studies with Muslim youth show that self-compassion partially mediates the link between trauma and the image of God, facilitating a reconfiguration toward mercy (Kıraç, 2022). In practice, this means teaching languages of kindness toward oneself ("talk to yourself as you would to a good friend"), normalizing shared pain ("what you're experiencing is part of being human"), and cultivating calm attention to intense emotions. Program micro-rituals: guided breathing, gratitude/comfort journals, "letter from a friend" exercises to oneself. In parallel, train secure-attachment routines: predictability in meetings, clear and affectionate rules, trustworthy adults who hold space for speech without rushing it (Kosarkova et al., 2020).

Accompaniment extends to families, especially in households under high stress (disability, chronic illness, precarity). In such contexts, caregiver data are consistent: a benevolent/accepting image of God is associated with better mental health—less hostility and interpersonal sensitivity, less paranoid ideation and psychoticism, and fewer obsessive–compulsive and phobic-anxiety symptoms (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c). Although these are not child studies, it is reasonable to infer that such spiritual climates modulate the possibility for children to speak without fear. Therefore, offer caregiver workshops on how to name God in a welcoming key,

how to listen to children's drawings and stories without correcting them immediately, and how to build brief rituals (e.g., "three good things of the day" plus a petition) in which children lead.

Intercultural sensitivity also requires reading grief and trauma in context. Children of migrants reconfigure presence and absence with their own theologies; the adult task is to legitimize and protect them, not replace them with formulas (Sarmiento, 2018). At school, offer a menu of metaphors that do not cancel experience (e.g., "God as a travel companion"), and in catechesis include testimonies by children from different backgrounds that show plural ways of sensing the divine (Baring, 2012; Volioti, 2021). As a safeguard, warn against propaganda—religious or atheist—that replaces grief with a slogan (Naydenova, 2016).

Finally, evaluate accompaniment with sensitive indicators: records of voluntary participation in speech/drawing activities; self-reports of felt safety to speak; changes in brief scales of God's closeness/benevolence (age-adapted); and, where appropriate, measures of self-esteem in relation to peers and adults (Smith & Crosby, 2017). To accompany is also to learn from what works and to correct what harms.

Devices for "saying and drawing god" without adult-centric tutelage

The point is to build devices in which children's authorship is not ceremonial but real. A first format is children's theology labs: regular sessions in the classroom or catechesis devoted to writing narratives, orally recounting experiences, composing "metaphors of God," and performing them with simple materials. The prompt is always invitational ("tell about a time when you felt help/care"), and the feedback is formative: it highlights connections between experience and metaphor, clarity of the narrative, and respect for diversity (Heland-Kurzak, 2019). A second format is visual cartographies: "my map of God in my week," where each child locates moments of care, play, study, and fear, noting where closeness or absence was perceived. This practice links iconography and biography and allows visual biases to be discussed with care (Moriguchi, 2022).

Word circles constitute a third device: gatherings with clear rules for turns, active listening, and the right to pass. Each week, two or three children are encouraged to moderate the circle—with adult accompaniment—thus learning facilitation skills and mutual recognition. This format strengthens the role of peers, whose direct influence on self-esteem is well documented, and gives the image of God space to mediate between experience and community (Smith & Crosby, 2017). In parallel, liturgies with children's voices are fostered: monitions, intercessions, creation of liturgical art, and selection of symbols. The aim is not to "infantilize" the rite, but to interrogate it from the child's voice so that it is a home and not a museum.

Books again become allies if chosen well. Plan reading cycles with works that bring the sacred closer through humor and everydayness, without renouncing the irony that sparks thought (Volioti, 2021), and avoid materials that function as univocal propaganda (Naydenova, 2016). Each reading ends with rewriting exercises: alternative endings, the character's journal, "letters to God" from the protagonist. In contexts of migration or absence, offer spaces for theologies of absence/presence where the prompt is "name what is missing" and the adult response is care (Sarmiento, 2018). Where the relationship with mother/father weighs heavily, try metaphors that allow healthy separations between the parental figure and the divine—or bridges when the child proposes them (Baring, 2012).

To avoid adult-centric tutelage, establish golden rules: adults ask open questions, refrain from correcting metaphors except when they explicitly harm others, and practice descriptive feedback ("in your drawing, God is next to the bed when you were sick; what made you think that?") rather than pronouncements ("God isn't like that"). To sustain the devices, use portfolios in which each child keeps texts and images, with brief self- and peer assessments—"what I wanted to say," "what I learned from

someone else's story"—(Smith & Crosby, 2017). And to give symbolic place to that authorship, organize classroom museums and community moments where works are exhibited with consent and protective frameworks.

Interculturality runs through all devices: children are invited to bring images and stories from home, imported biases are discussed ("why do so many images show God as old and white?"), and local translations that resonate with the group's experiences are tried out (Moriguchi, 2022). The selection of repertoires attends to diversity and proximity; exoticization is avoided, and plausible identifications are prioritized. Taken together, these devices operationalize the thesis: by saying and drawing God without tutelage, children transform repertoires, repair wounds, and, in practice, establish the right to their own theological voice (Heland-Kurzak, 2019; Smith & Crosby, 2017; Moriguchi, 2022; Volioti, 2021; Naydenova, 2016; Sarmiento, 2018; Baring, 2012; Kıraç, 2022; Kosarkova et al., 2020; Bonab & Koohsar, 2011b; Koohsar & Bonab, 2011).

Conclusions

This essay shows that the child's gaze on God is a political terrain where participation, recognition, and rights are at stake. The way schools, churches, families, publishers, and states organize representational devices is not neutral: curricula, iconographies, books, catechesis, and campaigns shape what can be said and seen about the divine and, thereby, enable or restrict children's theological voice. Pedagogical studies show that children construct rather than merely repeat: by ages 9–10 they reinterpret what is taught if the environment opens questions and listens (Heland-Kurzak, 2019). In community life, the image of God each child develops and relationships with peers directly predict self-esteem, and that image mediates the influence of family and church adults (Smith & Crosby, 2017). For its part, the visual plane proves its normative force: even outside Abrahamic traditions, early biases appear toward an elderly, white God (Moriguchi, 2022), which can reinforce symbolic hierarchies if repertoires are not curated. Literature and media confirm that stories either open belonging or discipline imaginaries—from the humor and closeness of Greek children's literature (Volioti, 2021) to the ambivalence of Soviet atheist propaganda (Naydenova, 2016). All of this supports the thesis: without representation policies oriented toward participation, plurality, and care, children's voices remain subordinated to adult centrism.

Normatively, rereading *imago Dei* from childhood (Hiskes, 2023) compels a shift from the child-as-object of evangelization or cultural policy to the child-as-subject who thinks, tells, and draws God. The practical conclusion is twofold: (1) institutions must redesign their devices— inquiry-based curricula with formative assessment; inclusive iconographies; catechesis with spaces for speech and children's leadership; books that invite narration—and (2) they must measure this transformation with indicators of voice, visual diversity, and peer bonding. Where these levers are activated, the image of God becomes a resource for belonging rather than a barrier to entry. Where they are not, silences and exclusions crystallize, affecting development.

The second thesis is also borne out: images of God do not float; they are embodied in biographies, affects, and relationships. The representation of the divine functions as a lived relational schema that is colored by attachment, trauma, and community and family climates. Health and clinical research indicate that childhood trauma and difficulties in close relationships are associated, in adulthood, with less benevolent images of God, especially in secular contexts (Kosarkova et al., 2020). In Muslim samples, subtypes of maltreatment predict negative divine images, with self-esteem as a partial mediator (Kıraç, 2021), and self-compassion in turn mediates the link between trauma and the image of God, offering a formative vector capable of reorienting representation toward mercy (Kıraç, 2022). In parallel, in families under high stress (caring for children with special needs), a benevolent/accepting image of God among caregivers is associated with better mental health (lower hostility, interpersonal sensitivity, paranoid ideation, psychoticism, obsessive–compulsive symptoms, and phobic anxiety),

suggesting climates more conducive to children's speech (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c).

The pedagogical–pastoral consequence is clear: a rights-based and interculturally sensitive proposal should (a) audit and review visual and narrative repertoires—deactivating age/race/gender biases and bringing the sacred closer to everyday life (Moriguchi, 2022; Volioti, 2021); (b) accompany grief and trauma with care protocols, practices of self-compassion, and routines that repair attachment (Kıraç, 2022; Kosarkova et al., 2020); and (c) create devices in which girls and boys say and draw God without tutelage: children's theology labs, visual cartographies of the sacred across the week, word circles, and liturgies with children's voices. Experiences of migration and parental absence further show that children generate situated theologies when they find legitimacy to name their world (Sarmiento, 2018), and that this theology dialogues with images of mother and father (Baring, 2012). Taken together, the conclusion is that to care for the image of God is to care for bonds and subjectivities: to educate sight, speech, and affect at the same time.

Considered together, both theses sustain a single movement: from representation to recognition. First, we showed that representing the divine in childhood is a field of power: curricula, iconographies, books, catechesis, campaigns, and homes decide who gets to see and be heard when speaking about God. Second, we demonstrated that those representations are anchored in affective histories and relational networks that can wound or heal, close down or open up. Hence the essay's practical orientation: cultivate the terrain. This entails redesigning devices to enable voice (Heland-Kurzak, 2019; Smith & Crosby, 2017), diversifying visualities and narratives (Moriguchi, 2022; Volioti, 2021), protecting the right to speak against one-way propaganda (Naydenova, 2016), and accompanying concrete biographies—especially those marked by migration, grief, or family stress—with tools of self-compassion and attachment care (Sarmiento, 2018; Baring, 2012; Kıraç, 2022; Kosarkova et al., 2020). Findings with caregivers reinforce the ecosystemic dimension: benevolent spiritual atmospheres are associated with better adult mental health and, foreseeably, with safer contexts for children to speak (Bonab & Koohsar, 2011a; 2011b; Koohsar & Bonab, 2011; Bonab & Koohsar, 2011c).

Normatively, the essay converges with Hiskes's (2023) proposal: reread *imago Dei* from children's ownership of voice. It is not enough to declare rights; they must be operationalized in practices where children think, tell, and draw God—and where adults, schools, communities, and states act as guarantors of that voice, not as guardians who place it under tutelage. The final conclusion is programmatic: if images of God are produced by devices and embodied in bonds, then we can transform them. There are concrete, measurable levers to change what is taught and what is seen, to heal what hurts, and to open spaces for children's authorship. Doing so not only improves self-esteem and well-being; above all, it makes public theology a just place where children are recognized as full interlocutors.

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Citizens' Perception of Political Leadership: An Institutional Analysis

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Introduction

It is necessary to understand citizens' perceptions of political leadership for several reasons. First, because in a democracy, political leaders derive their authority from the consent of citizens through the ballot box. Therefore, understanding how society perceives political leadership is essential for evaluating the legitimacy and acceptance of public policies and decisions (Masip et al., 2020). A positive perception of political leadership reflects satisfaction and trust in leaders and institutions, while if citizens feel that they are not represented, this creates a lack of popular participation and a disconnect between the rulers and the ruled.

Secondly, the perception of political leadership promotes accountability and transparency. Leaders who are concerned about public opinion are more likely to take responsibility for their actions and adopt measures to respond to citizens' demands and thus improve the quality of their governance.

Finally, any negative perception of political leadership has implications for the socio-political stability of any territory. Dissatisfaction or distrust of political leaders generates conflict, discontent, and social tension, with effects on the stability and general well-being of that community, contributing to the strengthening or weakening of democracy (Villasmil et al., 2021).

Therefore, in order to interpret the perception of communication exercised by political leaders in the Valencian Community, this paper has been structured into the following sections: Following this introduction, the next section presents the framework and literature review on the study of political leadership, showing its relevance in the field of social and human sciences, as it is a complex phenomenon whose role varies according to the context. It highlights those conceptions of leadership that have transcended time, showing that the culturalist-constructivist approach is the most appropriate for analyzing the information collected. Subsequently, the territorial framework under investigation is contextualized.

Understanding citizens' perceptions of political leadership is crucial at multiple levels within a democratic system. First, the legitimacy of political leaders is based on the consent given to them by citizens through their votes. Citizens' perceptions of their leaders are essential for assessing the legitimacy and acceptance of public policies, as a positive perception can reflect satisfaction with and trust in political institutions. In contrast, if citizens feel that their leaders do not represent them adequately, this can result in a decline in political participation and a disconnection from the political system.

The second reason for studying perceptions of political leadership is its relationship to accountability and transparency. A leader who is aware of public opinion and demands is more likely to be accountable for their actions, which in turn can contribute to improving the quality of their governance. This aligns with the concept that responsible leaders who respond to citizens' concerns can prevent conflict and foster social cohesion in their communities.

Finally, negative perceptions of political leaders can have serious consequences for socio-political stability. Mistrust and discontent toward political figures can generate social tensions that directly impact the well-being of a community, which in turn can weaken democracy. In this sense, understanding citizens' perceptions of leadership can be a vital tool for diagnosing problems that threaten social and political stability.

Based on this issue, the variable under study will be citizens' perceptions of political leadership in the Valencian Community, focusing on how these perceptions influence legitimacy and political participation. The problem statement can be formulated as follows: "How do perceptions of political leadership influence citizen participation and social stability in the Valencian Community?" The research question that will guide this study will be: "What factors affect citizens' perceptions of political leadership in the Valencian Community and what are their implications for governance?" Finally, the hypothesis proposed is: "A positive perception of political leadership is directly associated with higher levels of citizen participation and more robust social stability in the Valencian Community."

Based on the points discussed, it can be seen that the perception of political leadership is not only a fundamental component of democracy, but also acts as an indicator of the state of governance in any territory. This was already described by the researcher Guadarrama in his hypothetical model diagram on credibility in government communication. (164).

The methodology and characterization of the information used are shown below. This is followed by an analysis of the perception of political leadership in the Valencian Community, analyzing feelings, alternatives, the logic of governance, qualities, mistrust, and citizen (dis)satisfaction. Finally, a section on leadership from a gender perspective is included, showing the need for an inquisitive approach that promotes equality for women in all social spheres. This work concludes with the main conclusions.

Review and approaches to leadership

Leadership is researched from various fields of the humanities and social sciences, as it plays a fundamental role in the functioning of organizations and society in general. In recent years, extensive research has been conducted to understand the different aspects of leadership, its characteristics, styles, effects, and its impact on individuals and groups (Villasmil et al., 2021). Leadership is a social factor present in multiple activities, thus arousing the interest of researchers who seek to understand its importance and scope, as well as its impact on society. Therefore, this section reviews the social influence of political leadership and concludes with a recognition of the different approaches developed over time. According to Delgado (2004), political leadership can be understood as the ability of one or more individuals to influence the actions or thinking of a group or territory and thereby achieve a specific objective with maximum efficiency. Along the same lines, Rodríguez-Virgili et al. (2024) see political initiative as an interaction between society in general and political actors through which a common goal is achieved.

Thus, all political leadership will depend on the socioeconomic context in which it is situated. This explains the existence throughout history of various behaviors, such as "reactions to seductive initiative," which authors such as Weber (1924) pointed out as an impediment due to the possibility of conditioned navigation that would cause the control system to lose its objective. Also noteworthy is

the "analysis of deception or political corruption," which urges vigilance over political leaders given their propensity for degradation in their management and, with this, guarantees the simplicity and transparency of political leadership (Klitgaard, 1988).

In this regard, Heifetz and Linsky (2002) discuss "versatile authority," noting that political leaders must be able to adapt to a changing environment, while Campbell et al. (1960) assert that it is necessary to construct organized perspectives separated by rational ideologies so that people have stable and lucid political conceptions. These authors state that for individuals to adequately verbalize a political message, the following conditions must be met: understanding, questioning, and evaluating the strategy of political authority and clearly identifying the approach of each of the existing political forces.

In fact, Campbell et al. (1960) argue that a large number of voters are satisfied with fulfilling the above conditions, while others are loyal to a specific political ideology, which determines their evaluation (vote) of each political action. However, in recent years there has been a weakening of political loyalties and convictions due to the greater importance given to other factors, such as the individual's socioeconomic situation, social polarity, or the complexity of the international context, which influence voting decisions. This means that, despite the existence of stable voters, others have volatile voting tendencies, as pointed out by Abramson and Aldrich (1982) and Dassonneville (2016) in their studies on the behavior of the American and British electorate, respectively.

Countless methodologies have been considered to improve this discussion, focusing on understanding the complexity of the problem and the elements that impact an individual's political convictions. One of the most recognized conflicts is that related to the use of the left-right or liberal-moderate continuum (Luttbeg and Gant, 1985). This dichotomy leads us to the concept of political mentality, understood as a structured group of ideas around the conception of how political intervention in society should be.

However, the use of this dichotomy often reflects a redundant generalization that contributes little to understanding the evolution of the sociopolitical landscape (Linz and Stepan, 1996). This consideration leads Rodríguez-Díaz et al. (2023) to say that referring to the components of a liberal-moderate philosophy is a false simplification, given that there are a large number of points of view on legislative issues that facilitate the association of ideas in the political sphere. Conover and Feldman (1981) expand on this issue, adding four subsets of mentalities to the two outlined above: life theory; philosophical standards; financial, racial, and social convictions; and convictions on international strategy issues. In fact, it is possible to speak of a wide range of political mentalities beyond the liberal-moderate polarity.

The conclusion that can be drawn from this discussion of political conviction is the need to reexamine how people classify their perspectives and define their behavior on political issues. Therefore, research on political perspectives and behaviors seeks to understand what influences individuals' decision-making in the governmental sphere. In general, partisan identification is one of the most decisive factors in electoral behavior and political mindsets and sentiments, although other issues also influence these examinations, such as sociodemographic, economic, and territorial factors (Sánchez-Ferrer and Berzosa-Alonso, 2016).

But beyond the individual perception of political events, there is a collective assessment or public opinion, defined as the propensity or inclination of an audience or group of people toward the social reality that is important to them. Popular perception or opinion is an idea from political theory focused

on the realm of collective political correspondence, capable of altering individual political perception or discernment in one direction or another (Hernández, 2018).

Delving deeper into political cognition, this is a frequent area of research in academic literature. Political discernment or perception refers to the way in which people decipher and understand the political world around them. This is influenced by factors such as the information received, their qualities, convictions, experiences, and the way they process and evaluate each political event, and then give them a political meaning. Thus, discerning political issues is a process by which citizens classify and evaluate political data according to the circumstances of the moment and their interests, all of which impact their political mindset and behavior in this regard.

Authors such as Mata and Ortega (2013) noted that perceptions of political leaders directly influence political stability through voting, which is why it is important to conduct an informed analysis of this issue. According to Hernández (2018), understanding trends in political perceptions is key to understanding sociopolitical dynamics. The development of perceptions of political leadership in the midst of changing sociopolitical contexts is the field of interest of this research.

All of this allows us to affirm that political discernment is not limited to impartial data, but also includes individual understandings and assessments. Consequently, this work analyzes how the expectations and demands of Valencian citizens influence their perception of national and regional political leadership.

Approaches to leadership construction

To conclude this theoretical framework on leadership studies, it is necessary to mention the approaches related to its origin.

In this regard, first, it is worth mentioning the essentialist paradigm, which conceives of leadership as an intrinsic and inherent quality in certain individuals. Leaders are considered to possess innate traits and characteristics that distinguish them and enable them to influence others, these qualities being stable and enduring over time (Jiménez-Díaz et al. 2021). Thus, essentialism believes in the existence of natural-born leaders and maintains that they possess attributes (charisma, character, emotional intelligence, and communication skills) that make them stand out in a decision-making scenario. According to Villasmil et al. (2021), this view is close to geneticist positions in that it focuses on the personality traits of individuals who exhibit leadership characteristics.

On the other hand, the constructivist and culturalist approach to leadership focuses on how it is constructed from social, cultural, and interactive processes.

From a constructivist perspective, leadership is a social and relational construct that arises from the interaction between leaders, followers, and supporters, and is shaped and developed through communication, mutual influence, and group dynamics. Leadership is conceived as an emergent process in which roles, powers, and meanings are negotiated within a specific context (Villasmil et al., 2021; Viñas et al., 2023).

Meanwhile, from a culturalist perspective, leadership is shaped by the customs, beliefs, norms, and values of each culture and era. Therefore, leadership changes according to context and different

cultural practices. Thus, culture determines how leadership is defined and valued in socially accepted models and roles (Zuart, 2024), thereby facilitating the understanding of political decisions.

In the development of this work, the constructivist-culturalist conception proved to be the most appropriate for addressing the issue of citizens' perception of political leadership in the Valencian Community for the following reasons:

- Social construction of meanings: leadership is not a fixed entity, but is socially constructed and negotiated. Hence the need to understand the meanings of leadership in the Valencian political context.

- Leader-follower interaction: leadership is not something isolated; it must be interpreted together with those who are to be led. This highlights the importance of leader-follower interaction in constructing citizens' perceptions of leadership (Zuart, 2024). This helps to understand how roles, expectations, and values are negotiated between both parties.

- Relevance for decision-making: understanding public perception of leadership is essential for political, organizational, and social leaders. The constructive-cultural approach provides a solid basis for understanding changing public expectations and needs in terms of leadership, contributing to effective decision-making (Walter, 2015).

- Appreciation of cultural diversity: Spain is a diverse country, with different communities, each with their own traditions and culture. This approach addresses this diversity and explains how different regional contexts affect citizens' perceptions of leadership (Valenzuela-Saavedra, 2020).

Therefore, according to Villasmil et al. (2021), "to understand a person, we must investigate their social reality and the intersubjective processes that shape it (...)".

In short, good political leadership is essential for the functioning of a democracy, given its role in decision-making and in representing the interests and aspirations of society (Collado-Campaña et al., 2016). Conversely, in an authoritarian state, it can become a tool that perpetuates systems of social domination and the consolidation of power in the hands of a few. This makes it necessary to know whether there is a crisis in political leadership or whether it is altered in the face of crises.

3. Contextualization: leadership and the social landscape

In order to analyze the perception of political leadership, it is necessary to understand the environment under study. In the case of the Valencian Community, this is necessary for several reasons:

- Own frame of reference: Spanish politics has its own specific characteristics that condition the perception of political leadership at the territorial level. We are referring to the political system, institutions, political traditions, and inter-territorial power relations.

- Regional diversity: Spain is made up of different communities, each with its own cultural, socioeconomic, and political identity. Understanding this heterogeneity makes it easier to contextualize the perceptions of each territory and explain regional political dynamics in relation to the national landscape.

- Influence of national politics: many regional political decisions are influenced by those taken at the national level. Effective regional political leadership depends in part on interaction with national leaders and policies. Therefore, it is important to understand how regional and national

policies are intertwined when analyzing perceptions of political leadership (Ortega-Villodres and Recuero-López, 2020).

This need to adopt a broad perspective on leadership and recognize the characteristics of the context appears in Rivas (2019), who states that recent years have been very turbulent in Spanish politics, marked by a series of events that shook the country's sociopolitical landscape. These began with the financial crisis in 2008, which had a profound impact on the Spanish economy and generated great political mistrust (Jiménez-Díaz, 2013), which was reflected in the rise of new political parties such as Podemos and Ciudadanos in the 2015 general elections, leading to a fragmentation of the usual two-party system.

In short, various events have affected citizens' perception of political management at both the national and regional levels. Issues such as the change in national political leadership, the 2017 Catalan independence referendum, and the recent COVID-19 pandemic have generated uncertainty and citizen dissatisfaction with the ruling classes, leading to a loss of confidence in political institutions and leaders (Carratalá and Palau-Sampio, 2019; Hernández, 2018). Furthermore, as Jiménez-Díaz (2013) points out, the lack of transparency and recent cases of political corruption have only exacerbated this trend toward public mistrust of the political sphere.

In this context, certain political leaders have taken on the role of actors capable of channeling the discontent and unmet demands of the population. These leaders connect with citizens by addressing their concerns and offering grandiose proposals for change, thereby gaining influence and popularity (Jiménez-Díaz, 2013; Rodríguez et al., 2024; Rivas, 2019).

According to Guisán (2021), another aspect to take into account is that although Spain has many public employees with high professional quality, specialized knowledge, and experience (human capital), public attention is perceived unevenly. This may be due to multiple factors such as lack of resources, bureaucratization, inexperience in public management, etc. Thus, while some public entities stand out for providing quality service and efficient care, others are known for their inefficiency and slowness in providing the public service in question.

It is also worth considering the electoral system, understood as the set of norms and rules established for the election of political representatives, given that, depending on its greater or lesser rigidity, it can significantly influence the level of democracy achieved and, consequently, the perception of political leadership (Guisán, 2021). Thus, if the electoral system limits the participation of new political actors or hinders the representation of different opinions, it reduces democracy and concentrates power in certain political parties or leaders. Conversely, a flexible and equitable electoral system that facilitates citizen participation and allows for the proportional representation of political forces strengthens democracy by ensuring plurality of voices and political competition.

Political leadership in the Valencian Community

The fact that 30% of respondents answered that their parents are their most important leaders can only be explained from a constructivist-culturalist paradigm of leadership, showing the influence of personal experience on the perception of leadership, attributing the characteristic of leader to the closest bond. Constructivism considers that social reality is constructed and shaped by human interactions, norms, and shared cultural traditions. In this sense, parents play a fundamental role in the formation and socialization of the individual from an early age. On the other hand, 14% of respondents

say that the King is the most important leader, a fact related to Spanish tradition and cultural identity, where the figure of the monarch has a deep-rooted historical significance.

The 13% who mention doctors as important leaders is associated with the context of the pandemic (COVID-19). During this time, doctors not only provided medical care, but also saved lives and conveyed a sense of security to the entire population, which translated into great trust and recognition on the part of the public.

Ten percent of respondents mention the president as an important leader, reflecting the relevance of political leadership in decision-making and the management of public affairs. The president is the highest political authority and is expected to lead the country in the right direction.

Nine percent name teachers as leaders, based on their role as disseminators of knowledge and comprehensive educators of the whole person. This reinforces their leadership in the ability to inspire and motivate students and their role as guides in the learning process.

The 3% attributed to the police and mayors is linked to the management of local issues in security and the promotion of well-being. Thus, it can be seen that the message conveyed by politicians has little social influence in terms of results, remaining a rhetorical issue or empty words (Alonso and Martorell, 2018).

Sometimes, in a democracy, political leaders do not respond to social aspirations and needs, acting for their own benefit or that of a select group. In this case, there is neither representation nor citizen participation, limiting the possibility of freely expressing opinions and influencing political decisions. Meanwhile, in an undemocratic order, responsibility and accountability are seriously damaged. Political leaders are not accountable to their people, nor do they stand for regular elections, and there are no checks and balances to require them to explain their actions.

The crisis of political representation is a widely debated phenomenon in many countries, and Spain is no exception, characterized by growing public distrust of the political class and the perception that the authorities are not responding to their demands. This crisis is linked to two factors: the general political culture and corruption in the political class (Jiménez-Diaz, 2013; Villasmil et al., 2021).

Political culture plays a key role in the crisis of representation, as it refers to the political values, attitudes, and behaviors established by a society. When that culture is dominated by apathy, disaffection, and a lack of citizen participation, the citizen-politician relationship is weakened. This level of disinterest or belief that politics is irrelevant is followed by a lack of institutional trust and the perception that political leaders do not care about citizens' problems.

Meanwhile, corruption in the political class is a determining factor in the growing lack of political representation, demonstrating the abuse of power to obtain personal benefits or favor certain groups to the detriment of the general welfare. If the population perceives that politicians are involved in acts of corruption, bribery, embezzlement, or nepotism, mistrust in the political system as a whole increases (Jiménez-Díaz, 2013). Corruption amplifies the perception of a lack of representation, and in Spain it is one of the few arguments with some capacity to prevent ideological voting (Rodríguez-Virgili et al., 2024).

As a result of this crisis of representation, citizens are experiencing growing mistrust and a sense of alienation from their political representatives (Masip et al., 2020). Their voices are not being heard,

and the political message has a negative impact on public awareness, leading to political apathy and declining voter turnout.

Negative sentiment in the Valencian Community towards political leadership

One-third of respondents cite uncertainty, lack of certainty, and instability in many aspects of their lives as the main problem. This can be attributed to a crisis of representation, with individuals perceiving a disconnect between their demands and public decisions, leading to instability in relation to various aspects of the region's future. Uncertainty generates distrust of political leadership and prevents effective decision-making.

Some 27.4% of the population identifies politicians as the main problem. This perception reflects mistrust due to corruption scandals, lack of transparency, or the perception that the needs of the population are being ignored. Therefore, a good leader must work to maintain public trust.

Twenty-two point six percent of respondents consider the economy to be the main problem, reflecting their fears about issues such as employment, quality of life, and economic growth. Leaders must promote policies that favor sustainable economic development, create jobs, and reduce interregional economic disparities.

7.5% mention insecurity as the main problem, responding to concerns related to crime, violence, or the lack of security in everyday life. Thus, security policies, cooperation with law enforcement, and crime prevention programs must be promoted.

Finally, 6% of respondents point to unemployment as a major regional problem, revealing their concern about the lack of job opportunities and the impact this has. To solve this, the government must establish active employment policies, encourage business creation, and promote vocational training and education.

In conclusion, analysis of the data reveals that, from the perspective of political leadership, the main problems in the Valencian Community are uncertainty, political mistrust, the economy, insecurity, and unemployment. All of this means that the political message is perceived negatively. Responding to these needs will strengthen political leadership and contribute to sustainable development in the region by promoting stability, transparency, economic growth, public safety, and employment.

Furthermore, this perception of a lack of institutional representation would exacerbate the crisis of confidence in the political class, widening the gap between political leaders and citizens, who feel that their problems are not being adequately addressed and that their interests are not reflected in the policies implemented.

In this context, 30.4% of respondents believe that a new leader is the solution to the problems described, promoting the idea that citizens seek a change in political leadership as the solution to their

difficulties, while 21% respond that politicians are the solution. All of this highlights the need for effective leadership that can satisfactorily address current problems and challenges.

Fifteen percent of respondents answered "none" as a solution, which may be due to a lack of confidence in politicians and their message, with the perception that they are unwilling or unable to meet the needs of the population.

Thus, the lack of certainty, stability, and political representation reduces the confidence of the population of the Valencian Community in their politicians and generates a demand for change. In line with this consideration, the issue of political leadership assessment can be seen in the sum of the responses "new leader" + "none" + "don't know" (51.4%), which confirms the disenchanted political perception, leading to the question: how rationally do these leaders act?

The fact that 61.9% of responses relate the common sense of political leaders to their lack thereof (Graph 6) confirms the negative perception of them. This reinforces the idea that citizens perceive a lack of common sense in the decisions and actions of their political leaders, relating it to the socioeconomic crisis affecting the country.

Citizens perceive that their political leaders are incapable of making decisions based on common sense to meet their needs.

In turn, this lack of confidence in the common sense of political leaders can have negative consequences for citizen participation, political stability, and the legitimacy of the democratic system. However, it should be noted that we are talking about the subjective perception of the individual, which does not necessarily reflect the reality or the actual ability of the political leader (Rodríguez-Virgili et al., 2024).

Qualities that the Valencian Community expects from political leaders

The fact that honesty (79.5%) is overwhelmingly the most important quality that a political leader should have for the population surveyed suggests that they value integrity and transparency above all else. Thus, this innate aspect of a leader's personality (essentialist) highlights the importance of being perceived as honest and trustworthy, acting ethically and responsibly (Jiménez-Díaz et al. 2021).

When political leaders are seen as honest, it is because they are believed to make decisions based on moral principles and the common good. This perception strengthens the legitimacy of political leadership and builds a relationship of trust between leaders and citizens. Political leadership focused on the leader's personality implies that the leader is expected to be a role model and have a positive influence on society. Honesty establishes a relationship of trust and credibility and inspires citizens.

7.1% chose hard-working, which shows how a significant segment of the Valencian population identifies the commitment and dedication of political leaders as part of their responsibilities. Meanwhile, the response strength (3.2%) highlights the importance given to the determination of political leaders, their ability to face challenges and unforeseen events and overcome obstacles, both on a personal level and in public management.

Resilience (3.1%) assesses the ability to overcome difficulties, learn from them, and move forward, something especially relevant in the political arena where challenges and criticism are a daily

occurrence. This attribute highlights the need for flexible leaders who can adapt and overcome adversity.

The item of generosity (1.6%) as a quality of a political leader suggests that some citizens consider it important for leaders to be altruistic and committed to the common good, acting with empathy and concern for the well-being of others. Strength, resilience, and generosity, to varying degrees, complement honesty and thus contribute to building effective, trustworthy political leadership that is perceived as addressing the needs of Valencian society.

However, focusing on the personality of the political leader can divert attention from political actions, public policies, and ideological platforms. A charismatic or dominant personality can lead to authoritarian leadership that emphasizes the figure of the leader over democratic processes and citizen participation.

On this point, Romera and Parra (2018) recognize the multiplicity of factors to be taken into account when building leadership, and where personality influences the ability to exercise effective leadership. Below are some ways in which the increasing relevance of the political leader's personality is visualized.

- Charisma and ability to connect: the charismatic personality of the political leader inspires confidence and makes their proposal inspiring.
- Credibility and authenticity: leaders who project a genuine, consistent, and honest personality generate trust among the population (electorate).
- Leadership and decision-making skills: the personality of the political leader defines their leadership and decision-making, where determination, resilience, and empathy are highly valued.
- Public image and media perception: the personality of a political leader impacts their public image and how they are perceived by the media in particular and public opinion in general.

The Valencian Community's distrust of its leaders: affective polarity

The predominance of distrust as a feeling generated by political leaders (65% of the sample, Graph 8) shows signs of a crisis in leadership (Villasmil et al., 2021). The fact that the majority of respondents consider distrust to be the primary sentiment generated by their leaders is illuminating when it comes to understanding the relationship between political leadership and its perception in the region. Skepticism is the defining characteristic, the political message is not trustworthy, and the control over whether it is fulfilled is not effective (Alonso and Martorell, 2018).

This distrust can have different origins: corruption, public scandals, broken promises, lack of transparency, empty policies, or a sense of political distance from citizens (Piñuel, 2020). Thus, this negative perception weakens the bond between political leaders and Valencian society, preventing the building of a relationship based on trust and collaboration.

In addition, 17% say they have no particular feelings towards politicians, denoting indifference or apathy towards the political class, confirming this political disconnect. In the Valencian Community, there is a perception that the concerns and needs of citizens are not being properly addressed.

However, it is encouraging to note that 16% still trust the politicians in power, which can be seen as an appreciation of individual benefit or a perception of transparency with regard to that political leader.

Overall, the data obtained show a perception of great mistrust and skepticism toward political leaders. Political leadership is ineffective, affecting politicians' ability to establish fruitful communication, build consensus, and address the challenges facing the region. To restore trust and strengthen political leadership, political leaders must build an authentic, credible, and meaningful connection with their citizens.The impact of this situation leads to a loss of legitimacy, which translates into non-acceptance and rejection of the policies implemented, as well as a lack of citizen participation. But it can also intensify social polarization and fragmentation, leading to a deterioration in governance and decision-making as democratic institutions are delegitimized (Villasmil et al., 2021). As noted in the contributions of Pérez-Curiel et al. (2021), Law 19/2013 on Transparency, Access to Public Information, and Good Governance promotes transparency in public management and establishes mechanisms for citizens to access information on the activities of political leaders and institutions. It also encourages citizen participation in public affairs and establishes mechanisms for expressing opinions and contributing to effective decision-making. However, despite the transparency and access to information rules established by law, the mistrust observed toward political leaders reflects great skepticism about the veracity and integrity of the information communicated by politicians. At this point, it is necessary to add the concept of affective polarization, which Garrido et al. (2021) refer to as "(...) an emotional distance, the distance between the attachment or affection generated in us by those who share our political ideas and the rejection or antipathy aroused in us by those who defend different ideas." Although no specific information was collected on political party affiliation, the high levels of distrust observed can be understood in these terms. Thus, affective polarization can increase distrust of political leaders in several ways (Garrido et al., 2021):

- Creating emotional camps: polarization divides society into opposing emotional groups, hindering dialogue and consensus. This increases political distrust, as it is understood that they represent only a part of the population.

- Spreading stereotypes and demonization: in a polarized environment, it is easy to exacerbate differences and stigmatize the political leaders of opposing groups. Demonizing them by associating them with enemies or adversaries.

- Perceived lack of objectivity: affective polarization reduces the perception of impartiality and objectivity in political leaders. People believe that these leaders are emotionally biased, and mistrust in their ability to make rational decisions grows.

Although political polarization is the subject of research in various disciplines (political psychology and sociology), understanding of affective polarization and its impact on Spanish society is limited (Garrido et al., 2021). It is important to contribute to a deeper understanding of this issue, as it is relevant to understanding the interactions between citizens and political parties and how it affects the functioning of democracy (Valenzuela-Saavedra, 2020). Through the link between political leadership and what is most disliked and most liked in the socio-political space under investigation, it is possible to identify significant relationships in this regard.

In the data obtained (Graphs 9 and 10), 52.6% of respondents detest politics and politicians in the Community, the highest percentage of all the negative aspects mentioned (add 4.2% for lack of political empathy). This suggests great dissatisfaction with political leadership and the decisions made by regional politicians; the political message is false, and what politicians say is not credible. This negative perception of politics and politicians is due to a lack of confidence in government management, corruption, inefficiency, or lack of transparency. Meanwhile, among the desirable

aspects, there are no attributes related to the institutional or sociopolitical framework, a fact that means that the subject is not disruptive in their decision as a voter despite their negative perception of politicians; they do not see any positive elements that would make them change their vote (Rodríguez-Virgili et al., 2024). The subject is disenchanted. However, it should be noted that these data reflect the opinion of the respondent and do not necessarily represent an objective assessment of political leadership in the Community. Nevertheless, the high proportion of people who dislike politics and politicians shows a clear negative relationship between the perception of political leadership and general opinion. However, based on the results obtained, it is possible to conclude that many of the respondents perceive a gap between the values they applaud and the reality of the political practices followed by their politicians, through which they create new barriers and challenges to their full participation.

In the 20th century, the public sector focused on providing basic services and social welfare for the population, considering that it was the responsibility of the state to guarantee equitable access to these services and protect the common interest. The current context "(...) requires new instruments, including the skills to generate decision-making processes with guarantees of permanent adaptation to the situations faced" (Pereda-Pérez et al., 2018). Thus, although the basic objectives of the public sector did not change, its approach did, with updating and differentiation becoming differentiating factors.

With globalization, new technologies, and the complexity of new international challenges, the public sector must adapt and recognize the role of interaction between the actors involved (Viñas et al., 2023). The scope of "public" interest grew disproportionately to address issues such as sustainable development, environmental protection, technological innovation, gender equality, social inclusion, and citizen participation. The aim is to promote more efficient and transparent management and to encourage collaboration and participation by all actors, including civil society, the private sector, and international institutions.

Complex and global challenges require comprehensive and cooperative solutions, and the public sector must interact with other actors to achieve effective results (Piñuel, 2020). This involves establishing partnerships, increasing citizen participation, promoting transparency, and adopting evidence-based and innovative approaches.

Political leadership from a gender perspective

The analysis of female leadership is essential in leadership studies for reasons such as gender equality, diversity, equal representation in leadership roles, and recognition of the unique characteristics and experiences that women bring to leadership.

First, it is necessary to analyze female leadership to promote gender equality. Historically, women have overcome barriers and challenges to access leadership positions, yet remain underrepresented in these roles. Thus, this field of research allows us to address and identify gender inequalities and biases that persist in society and organizations (Romera and Parra, 2018).

Furthermore, analyzing female leadership helps to promote diversity in leadership roles, bringing different perspectives, approaches, and skills, which can lead to more effective decision-making. Another reason for this analysis is to recognize and value the unique characteristics and experiences that women bring to leadership. By showcasing the achievements and contributions of women leaders

(businesswomen and politicians), stereotypes are broken and opportunities are opened up for other women to seek and attain leadership roles in their respective fields (Bullough and de Luque, 2015).

However, "in order to analyze female leadership, it is necessary to review the difficulties women have faced in accessing and promoting political activity" (Romera and Parra, 2018). Unequal access to leadership positions is a response to gender inequalities in many different aspects, mainly due to gender stereotypes (Pereda-Pérez et al., 2018). These generally stem from tasks associated with male roles, professional development in the public sphere, and the perception of women as having a professional role linked to household activities, constituting a feminization of activities and occupational discrimination.

The above falls within the framework of the so-called "glass ceiling," a concept referring to the invisible barrier that prevents women from advancing beyond a certain organizational hierarchical level (Ruiloba, 2013). This differential in access to leadership positions has negative effects for women individually and for society as a whole (Pérez-Curiel et al., 2021; Pereda-Pérez et al., 2018), as it limits the potential and talent that women can bring to leadership roles, leading to a lack of diversity of perspectives and experiences in decision-making.

In Spanish politics, some well-known women have managed to break into positions usually occupied by men. However, despite the relevance of these figures, there are still few women in public office in roles not traditionally considered feminine, reflecting persistent gender inequalities in the political sphere, coupled with a more collaborative and protective emotional consideration that distances them from the traditional view of the role linked to power in the public sphere (Bullough and de Luque, 2015). Patriarchal structures and gender stereotypes rooted in Spanish society continue to influence the unequal distribution of power and political leadership roles (Romera and Parra, 2018).

This limitation of opportunities for women in Spanish politics reinforces the glass ceiling that limits their access to the highest levels of political leadership. Therefore, in order to address this reality, actions are needed to promote greater gender equality in politics and remove limiting obstacles.

In this regard, data obtained through the study by the Social Observatory for the Valencian Community (November 2022) reveal some important aspects regarding the attributes of female leaders

The results show courage as the most important attribute of female leadership, being a strength in the fight for gender equality and the promotion of more equitable representation in political leadership roles.

The fact that courage obtained a 21.7% response can be related, as suggested by the authors considered, to political leadership, competitiveness, and gender inequalities, among other causes (Ruiloba, 2013), and where the greater assertiveness and collaborative nature of women leaders creates a significant perceptual difference (Bullough and de Luque, 2015).

But even more striking is the fact that the second most common response (18.4%) was that they could not find any notable attributes in women leaders, reflecting a lack of visibility of the qualities and skills that women can bring to leadership. This negative assessment is coupled with a feeling of distance between "administration and administered" and reinforces the sense of disconnection, lack of direction, or discontent with the way gender inequalities and political representation are being addressed in the Valencian Community.

Therefore, it is necessary to promote greater awareness of the capabilities and achievements of women leaders, challenging stereotypes and encouraging an equitable assessment of their contributions, or

it may be that the actions of political leaders observed by respondents are not what was initially expected.

Another attribute considered is entrepreneurship, with 17.1% of responses highlighting the ability of women leaders to take initiative, assume risks, and seek new opportunities. Recognizing the entrepreneurial spirit of women leaders means valuing their ability to generate positive change and contribute to social development and progress.

Also noteworthy are the attributes of open-mindedness (12.2%) and empathy (10.2%), qualities that emphasize flexibility, understanding, and the ability to listen. Leadership based on openness and empathy fosters inclusion, collaboration, and fair decision-making.

The responses that say they do not know what the attributes of women leaders are (9%) may be due to a lack of information or disinterest in female leadership; the visibility and dissemination of the achievements and skills of women leaders should be promoted. To a lesser extent, resilience is mentioned (5.2%), highlighting the ability of women leaders to overcome obstacles, adapt, and learn from difficult experiences.

In summary, the perceptions of the Valencian Community regarding the attributes of women as leaders reflect the importance of recognizing courage, entrepreneurship, open-mindedness, and empathy as notable qualities of their leadership. However, it is also necessary to address the lack of knowledge and awareness of their achievements and the fact that the results of their actions have not always been as expected.

To this end, various strategies can be implemented, such as disseminating success stories of women leaders and promoting mentoring and training programs for women leaders. In addition, it is essential to challenge entrenched gender stereotypes and foster an inclusive culture that values diversity of skills and leadership approaches.

Ultimately, it is necessary to promote policies and actions that foster gender equality in all areas, including politics. This involves addressing gender inequalities and biases that persist in the distribution of power, eliminating barriers and obstacles that prevent women from accessing leadership positions, such as the "glass ceiling" and occupational discrimination.

Conclusion

The results collected by the social observatory of the Fundación Liderar con Sentido Común (FLSC) in the Valencian Community from the analysis of political leadership allow us to delve deeper into the socio-political perception of its population and the contextual characteristics that define the spatial framework of the study, from a constructivist and cultural leadership perspective of reality. This social conception of leadership can be seen in "Who is a leader for you?", where the answers "parents + doctors + the King + teachers" account for 70%.

The results highlight a lack of trust and a negative perception of political leaders, both linked to the crisis of representation observed. Political activity does not reduce social uncertainty; 27.4% of respondents see politicians as the source of their problems, and 15% consider politicians incapable of reversing the mistrust that hangs over their leadership. This means that the democracy-society relationship is at a turning point, an issue that is growing in importance given that 62% of those surveyed perceive little rational sense in the actions of politicians.

Hence, mistrust (65%) and contempt (52.6%) are common feelings regarding the actions and messages of political leaders. However, the results also show that for this message to be socially valued, it must

be accompanied by honesty, rationality, hard work, and attention to the real problems of Valencian society; political rhetoric is not enough.

In addition to considering the characteristics of the crisis of representation and the individual attitudes of political leaders, this analysis included a gender perspective, recognizing that women are a group conditioned by inequalities that hinder their access to and permanence in leadership positions on equal terms with men. Hence, the trait most attributed to women in the Valencian Community is courage. However, they do not escape the general conception regarding the need to apply greater rationality and common sense to their political work (18.4%).

To explain all of the above, it is a good idea to leave a hypothetical model for analysis , the development of which can help you cross-reference variables and ask more questions about what happens inside and outside a public administration.

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Towards a Culture of Peace: Service as the Heart of Social and Academic Practice

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This chapter is part of the analysis of the historical legacy of the television program El Minuto de Dios, recognizing its seventy years of impact in promoting a culture of peace in Colombia.

Introduction

The persistence of armed conflict, social inequality, and mistrust in institutions has positioned Colombia as one of the Latin American countries where building a culture of peace remains both an ethical and political imperative. Within this context, various social, religious, and academic organizations have played a crucial role in promoting community-based initiatives that advocate for social justice, collective well-being, and reconciliation. Among these, the work of El Minuto de Dios stands out - a project initiated in 1950 by Father Rafael García Herreros, which has since become a national reference in service, spirituality, and social commitment, especially toward the most vulnerable sectors of the population (García Herreros, 2009).

The proposal to frame a culture of service as a pillar in peacebuilding aligns with an ethical and humanistic tradition that prioritizes recognition of the other, empathy, and solidarity as tools for social transformation. Promoted by El Minuto de Dios, this notion has transcended its religious origins to become a pedagogical, community-oriented, and political practice across different territories. It has contributed to human development processes grounded in equity, dignity, and justice. In this regard, service is not understood as a charitable or paternalistic act, but rather as an emancipatory practice that strengthens social bonds, civic responsibility, and a spirituality rooted in social commitment.

Francisco Jiménez Bautista (2019), in his reflections on a culture of peace, argues that such a culture entails more than merely the absence of war or direct violence - it requires a structural transformation of power systems, interpersonal relationships, and living conditions that perpetuate exclusion. From this perspective, a culture of service becomes one of the most robust strategies for building lasting peace, as it places care for others at the core of social and political life. This raises the central question guiding this research: Why does a culture of service foster peace?

On the occasion of El Minuto de Dios's 70th anniversary, it becomes essential to shed light on its legacy, not just as an evangelizing project, but as a concrete experience of socio-territorial transformation. This research is grounded in the recognition that service - when assumed as a foundational value - can become a powerful tool for reconciliation, inclusion, and collective resilience. This has been evident in territories marked by inequality, armed conflict, and institutional neglect, such as the department of Norte de Santander - particularly in the regions of Cúcuta and El Catatumbo - where histories of violence converge with grassroots resistance and community-based peacebuilding efforts.

These areas, historically affected by forced displacement, the presence of illegal armed actors, and state abandonment, have also been spaces of active intervention by El Minuto de Dios through educational, social, and spiritual initiatives. In this reality, the present study aims to reveal the contributions of the El Minuto de Dios program to peacebuilding by strengthening a culture of service

as the core of human praxis. The objective is to interpret how these practices - beyond their symbolic value- constitute concrete forms of social and ethical agency capable of transforming imaginaries, rebuilding social fabric, and generating hope amidst adversity.

This work adheres to a methodological approach consistent with the principles of systematization of experiences. It aims not only to document a meaningful intervention but also to understand its internal logic, its effects on the participants involved, and its potential for replication. In doing so, the research offers the academic and social fields a situated, critical, and reflective perspective on the link between a culture of service and peace - understanding that it is within the everyday, the local, and the human where the horizon of a possible country is shaped.

This study was conducted under a qualitative, interpretive approach, adopting the systematization of experiences as the central methodological design. This approach is justified by the intention to reconstruct, understand, and critically interpret a significant sociocultural experience - namely, the legacy of the El Minuto de Dios program in contexts marked by inequality, hope, and transformative community action. In the words of Jara (2018), systematization allows for re-signifying lived experience as a valid source of knowledge production, rooted in situated practice.

Specifically, the model of systematization proposed by Ruth Valera (2006) was adopted, which structures the work into five phases: (1) starting point of the experience, (2) formulation of the systematization plan, (3) recovery of the lived process, (4) in-depth reflection, and (5) learning outcomes (see Figure 1). This model recognizes practice as a generator of theory and places experience in dialogue with knowledge, thus allowing for movement from the particular to the general, in a process of situated conceptualization and theorization (Valera, 2006).

Figure 1. Phases of the Systematization Process



Source: Authors.

Data collection

The study was carried out in the department of Norte de Santander, Colombia. The selected areas were Cúcuta, Ocaña, Tibú, and El Tarra—locations that form a socially and territorially significant

corridor, both due to their historical connection with Father Rafael García Herreros and their current roles in peacebuilding and community transformation processes.

Participants

The participant population included 444 individuals from various segments of the educational and social community: 50 alumni, 260 current students, 84 administrative staff and faculty from the Corporación Universitaria Minuto de Dios (UNIMINUTO), 32 family members benefiting from the social programs of the Organización Minuto de Dios, and 18 representatives from partner institutions in the region.

Sampling was intentional (Sampieri *et al.*, 2014), designed to ensure the inclusion of key actors with direct, experiential knowledge of the processes linked to the "El Minuto de Dios" program. Inclusion criteria considered active or former involvement in the organization's initiatives and a voluntary willingness to contribute their experiences. Individuals with no verifiable connection to the Corporation's projects or without access to virtual or in-person participation tools were excluded.

Data collection techniques

The data were collected prospectively using three main techniques:

1. Document analysis: Institutional archives, mission statements, and historical records were reviewed to address the foundational dimension of the program and define the theoretical categories of inquiry.

2. Questionnaires: Administered virtually to ensure accessibility for participants. The questionnaires, designed around predefined theoretical categories, captured participants' perceptions, evaluations, and reflections on the experience.

Data analysis

Analytical techniques aligned with the interpretive approach were employed to examine the collected data. Content analysis (Bardin, 2013) was used to examine documentary and mission-related materials, allowing the identification of thematic cores, symbolic patterns, and ethical orientations in institutional discourse. For the questionnaire data, inductive thematic analysis (Braun & Clarke, 2006) was applied, organizing findings into emergent categories.

It is important to note that the results presented in this chapter correspond exclusively to the outcomes of the systematization process from the perspective of students and alumni.

The data presented in this section stem from the systematization process of meaningful experiences developed with students and alumni of the Corporación Universitaria Minuto de Dios (UNIMINUTO) at its campuses in Cúcuta and Catatumbo. These results correspond to the last three phases of the process: recovery of the lived experience, in-depth reflection, and lessons learned.

Meaning and Significance of the Obra Minuto de Dios

The systematization of experiences with UNIMINUTO students and alumni in Cúcuta and Catatumbo reveals that the spiritual and social legacy of the El Minuto de Dios program transcends its television format to become a deeply rooted ethical and pedagogical reference in the everyday lives of its audience. The emblematic phrase "My God, we place in your hands this day that has passed and the night that arrives" inspires a lived spirituality that weaves together gratitude, faith, collective identity, and inner peace. This experience not only reinforces the transcendent dimension of existence but also consolidates a culture of gratitude and service that promotes everyday practices of reconciliation and care for others in territories historically fractured by conflict.

Likewise, the program is recognized for its coherence between discourse and action: social initiatives - such as education, housing, and healthcare- are valued as tangible manifestations of faith embodied in social justice. This link between spirituality, symbolic memory, and community commitment positions El Minuto de Dios as an active agent of peace, capable of restoring broken bonds, strengthening hope, and offering a transformative vision of the country rooted in everyday life. However, the study also calls for a critical reassessment of how this legacy might avoid being reduced to a nostalgic symbol and instead be projected as a living, updated, and contextualized pedagogy in light of contemporary challenges.

Feeling and Thinking about the Culture of Service

The phrase "Let no one be left without serving" was internalized by participants as a guiding principle for daily actions, community engagement, and ethical leadership. The culture of service within academic and social formation is reflected in significant transformations in the perception of education. It redefines professional development in terms of empathy, equity, and territorial commitment. Access to education was also highlighted as an opportunity in vulnerable contexts, and social leadership emerged as a result of grounded formative experiences.

The participants' experiences demonstrated diverse ways of contributing to peace in everyday life: volunteering, values-based education, community projects, and pedagogical practices with an ethical approach. However, some cases of limited or passive participation were also identified, revealing gaps in how these institutional initiatives are lived and internalized.

Service at the heart of the culture of peace

The findings show that UNIMINUTO's educational model—especially in contexts such as Cúcuta and Catatumbo—combines academic knowledge, social commitment, and active spirituality. Student voices emphasized that service is not perceived as an occasional act but rather as a daily practice that fosters empathy, social justice, and environmental transformation.

Nevertheless, internal tensions were also revealed: a significant portion of students reported minimal participation in these initiatives due to structural factors such as virtual modality, lack of time, or low institutional visibility of these actions. This contrast highlights a gap between pedagogical ideals and their actual appropriation, challenging the university to strengthen mechanisms for inclusion, accessibility, and follow-up.

The analysis of the results makes it possible to answer the central question—Why does a culture of service build peace? —and to understand how UNIMINUTO students and graduates have reinterpreted the legacy of El Minuto de Dios through the lens of a culture of service and peacebuilding. The findings suggest a meaningful appropriation of both the spiritual and institutional message, which is translated into ethical, community-oriented, and educational practices.

These results are consistent with recent studies that recognize the role of universities in conflict-affected contexts as agents of social reconstruction through holistic pedagogies (Tatar-Garnica & Vargas, 2021; Rengifo-Silva, Vivas-Prieto & Meza-Salcedo, 2023). Likewise, research by Plata Rodríguez and Plata Quezada (2022) has highlighted how religious media with national reach can serve as informal educational platforms that promote democratic values and pacifist attitudes—especially when their messages are accompanied by concrete actions for social transformation.

The inclusion of the spiritual component as part of the educational process represents a key strength of UNIMINUTO's model. As Rodríguez (2023) points out, the link between faith and social commitment reinforces comprehensive education and stimulates civic participation in vulnerable contexts.

However, the heterogeneity of responses and the narratives of passive involvement reveal a structural limitation: the lack of systematic mechanisms to guarantee equitable access to peacebuilding activities

within the academic community. This limitation has also been noted in other studies on values-based education in higher education settings (Briceño Núñez, 2024), which emphasize that the sustainability of these approaches depends on their effective integration into the curriculum and institutional culture.

One of the most relevant contributions of this study to the existing body of knowledge is its empirical demonstration of how a religious-media legacy can become an educational device with a tangible impact on subjectivity and community engagement - particularly in socially fragile regions such as Catatumbo. This perspective broadens the traditional approach to peace education by integrating spirituality as a mobilizing dimension of the ethical subject.

For educational practice, the findings suggest that strengthening the culture of service must be accompanied by reflective training in ethical citizenship, thus avoiding merely assistentialist approaches. Institutions should develop strategies to ensure the active participation of all students, especially those enrolled in virtual programs or facing labor-related constraints.

From a research standpoint, this study opens new lines of inquiry regarding the role of symbolic languages and religious media in shaping subjectivities committed to social transformation. In post-conflict contexts, these findings could inform the design of reconciliation pedagogies with deeper cultural grounding.

One of the study's key strengths was its ability to gather diverse voices from territories facing high social complexity, which enabled a broad understanding of the meanings attributed to the culture of service. However, the qualitative nature of the design limits the generalizability of the findings. Moreover, the absence of comparative contrasts with other universities or regions narrows the study's scope for broader applicability.

Conclusions

This study aimed to understand how students and graduates of UNIMINUTO in Cúcuta and Catatumbo reinterpret the spiritual, pedagogical, and community legacy of the television program El Minuto de Dios, in relation to the culture of service and peacebuilding in contexts marked by exclusion, poverty, and armed conflict. Through the systematization of experiences, deep meanings were identified that connect spiritual life with social commitment, institutional identity with transformative action, and education with ethical processes of reconciliation.

The results revealed that the phrase "My God, we place in your hands this day that has passed and the night that arrives" has been internalized by participants as a daily spiritual practice that fosters gratitude, serenity, and the recognition of others in adverse settings. Similarly, the motto "Let no one be left without serving" was not perceived as an abstract institutional slogan but rather as an ethical horizon that guides personal, community, and professional decisions in socially complex environments.

The El Minuto de Dios program was recognized as a spiritual and symbolic reference, whose coherence between words and acts of solidarity has inspired leadership processes, values-based education, and community organization. In particular, the findings revealed that the culture of service promoted by the institution has served as a catalyst for personal transformation, educational inclusion, and active participation in peacebuilding through everyday actions.

One of the most significant implications of this study is the need to rethink university education from a territorial, spiritual, and ethical perspective. In post-conflict contexts such as Catatumbo, the integration of education, faith, and social commitment can encourage the emergence of ethical subjectivities oriented toward service and reconciliation. However, the analysis also suggests that these experiences are neither homogeneous nor universally shared, raising challenges for their institutional sustainability.

Finally, the study recommends continuing to explore the role of symbolic languages and spiritual expressions in peace education—especially in contexts where faith constitutes a structuring axis of daily life. Understanding these dynamics may offer new pedagogical pathways to strengthen an ethical, critical, and compassionate citizenship capable of responding to urgent social needs from a deeply humanizing perspective.

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Effects of Physical Activity on Sleep Quality in Adults: Assessment of Nighttime Rest

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Introduction

Since the post-pandemic period, sleep quality has become substantially relevant to the psychological and social well-being of the adult population, as it is a sensitive indicator of biopsychosocial balance in the face of new life dynamics, intensified use of technology, and work or educational overload. Recent literature indicates that sleep is not only related to physiological restoration, but also to cognitive and emotional processes that are fundamental to self-regulation, memory, and mental health (Miró, Cano & Buela, 2005). Thus, sleep deprivation has been strongly linked to high levels of stress, anxiety, and depression, damaging both the functional aspect and subjective appreciation of well-being (Bian et al., 2022).

Regarding methodology, the Pittsburgh Sleep Quality Index (PSQI) is presented as the main instrument for conducting a comprehensive assessment of sleep quality, due to its empirical support and credibility in various cultural contexts (Buysse et al., 1989). Most of the research reviewed incorporates correlational or cross-sectional designs, focusing on the university population, adults, and to a lesser extent older adults, reflecting a tendency to explore associations rather than causal mechanisms (Montero & León, 2002). Similarly, the impact of behavioral factors such as the use of electronic devices before bedtime has been shown to be a significant determinant of reduced sleep duration and quality (Pham et al., 2021).

Overall, the results of this review suggest a stable pattern: lower sleep quality is associated with a greater presence of symptoms of anxiety, stress, and depression, while resilience and psychological well-being act as protective factors. Despite this, most studies focus on subjective and self-reported measures, without incorporating objective tests such as actigraphic recordings or wearable technologies that allow the perceived experience to be contrasted with physiological data. This absence in the methodology marks an imminent research agenda that brings together psychosocial, neurobiological, and behavioral variables to understand sleep quality and its effect on current mental health in a more comprehensive way.

Research questions (RQ)

P (Population): Adults (≥18 years), including young adults, the general population, and older adults, in a post-pandemic context.

I (Intervention/Exposure): (a) Psychoeducational or mind-body interventions (e.g., digital mindfulness, breathing/yoga, CBT); (b) where applicable, use/feedback from physical activity monitors or digital technologies related to rest.

O (Outcomes): Sleep quality (overall and subdimensions: latency, efficiency, awakenings), daytime sleepiness, and psychosocial indicators (anxiety, stress, depression, well-being, resilience), mainly using PSQI and ISI; preferably—when available—objective parameters obtained by monitors (actigraphy, wearables).

Protocols and standards.

The review was designed under PRISMA 2020. It is recommended that the protocol be registered in PROSPERO before data extraction begins. Any methodological deviations will be published.

Stage to be defined.

Table 1. *Time, scope, and database for collection*

Time	**The search was conducted from September 1 to October 16**
Scope	The study covers the objective of psychological effects on sleep quality in the post-pandemic stage. Open access articles were considered. The languages included were English and Spanish. The period covered was from 2020 to October 2025.
Database	The Scopus and Scielo databases were used to search for articles.

Figure 1. Flowchart for bibliographic selection according to the Prisma Method

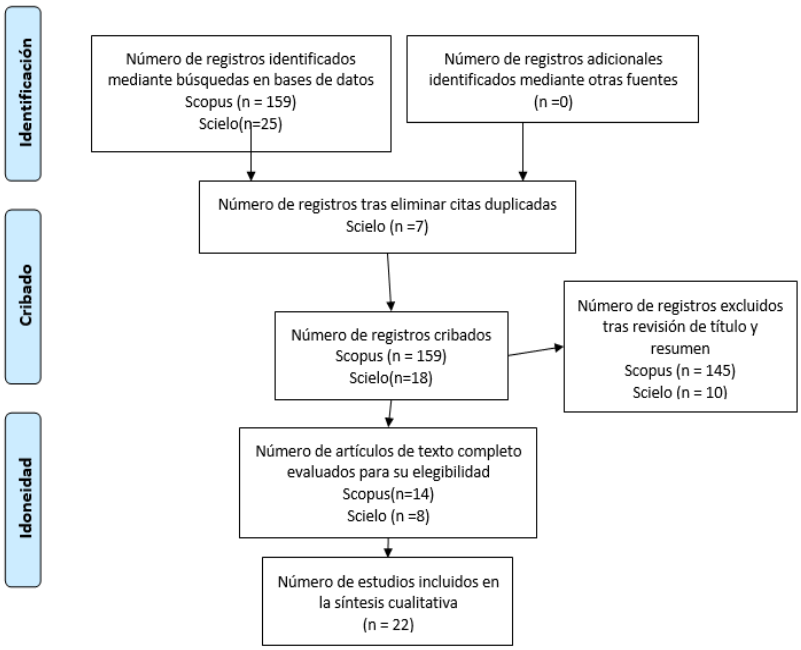


Table 2. *Eligibility criteria for scientific articles*

Authors	Language	Year	Sample	Type of study	Instrument	Indexed
Alperen Aksakal, Erdi Aksakal, Feridun Kaya, Buğra Kerget, Dursun Erol Afşin, Ömer Araz	English	2025	301	Relational	Pittsburgh Sleep Quality Index (PSQI), Brief Resilience Scale (BRS), Warwick-Edinburgh Mental Well-being Scale (WEMWBS).	Scopus
Jonathon K. Lisano, Carillon J. SkrzynskiCarillon J. Skrzynski, Gregory Giordano Gregory Giordano, Angela D. BryanAngela D. Bryan, L. Cinnamon Bidwell	English	2025	171	Experimental	Depression, Anxiety, and Stress Scale-21: DASS-21, Pittsburgh Sleep Quality Index: PSQI	Scopus
Margarita Helles, Richard Fletcher, Mirjam Münch, Romero Gibson	English	2024	498	Descriptive	Pittsburgh Sleep Quality Index (PSQI),	Scopus
Michelle Carr 1, Alejandro Yoo 2, Doña Guardino 3, Wyatte C. Hall 4, Scott McIntosh 5, Wilfred R Pigeon	English	2022	20	Relational	Validated questionnaires	Scopus
Danielle C. Mathersul 1 2 3, R. Jay Schulz-Heik 3, Timothy J. Avery 3, Santiago Allende 3 4, Jamie M. Zeitzer 4 5, Peter J. Bayley	English	2023	144	Exploratory	Sudarshan Kriya Yoga; SKY. Cognitive Processing Therapy [CPT]	Scopus
Mateusz Łuc, Marcin Pawłowski, Karolina Fila-Pawłowska, Dorota Kamińska, Paweł Poznański, Julia Rymaszewska, Piotr Krajewski, Dorota Szcześniak, Joanna Rymaszewska	English	2023	270	Relational	Insomnia Severity Index. General Health Questionnaire 28. Perceived Stress Scale	Scopus
Marcela Z. Campanini 1, Alberto D. González 1, Selma M. Andrade 1, Edmarlon Girotto 1, Marcos AS Cabrera 1, Camilo M. Guidoni 1, Paula CA Araujo 2, Arthur E. Mesas	English	2022	530	Relational	Pittsburgh Sleep Quality Index (PSQI). LBPc.	Scopus
Gülen Suna 1, Aylín Ayaz 2	English	2022	568	Relational	Pittsburgh Sleep Quality Index (PSQI). Eating Attitudes	Scopus

					Test-26 (EAT-26). Night Eating Questionnaire (NEQ). Beck Depression Inventory (BDI)	
Sarah Dash 1, Matthew Bourke 2, Alexandra G. Parker 3, Kara Dadswell 2, Michaela C. Pascoe 4	English	2022	239	Relational	Online questionnaire	Scopus
Andrea Romigi 1, Nicola B. Mercuri 2, Marco Caccamo 1, Federica Testa 1, Giuseppe Vitrani 1, María Carmela Tripaldi 3, Diego Centonze 1, Fabricio Jacoangeli 3	English	2022	34	Relational	Pittsburgh Sleep Quality Index (PSQI). Epworth Sleepiness Scale. Beck Depression Index	Scopus
Noé Chase Berman 1, Angela Colmillo 2, Susanne S. Hoeppner 3, Hannah Reese 4, Jedidiah Siev 5, Kiara R. Timpano 6, Michael G. Wheaton 7	English	2022	841	Relational	Battery of self-report questionnaires and psychometrically valid and reliable paradigms	Scopus
Mari Hysing 1 2, Ove Heradstveit 3 4, Allison G. Harvey 5, Sondre Aasen Nilsen 3, Tormod Bøe 6 3, Borge Sivertsen	English	2022	10 257	Relational	Youth@hordaland self-report questionnaires	Scopus
Yahua Zheng #1, Lili Wang #2, Ling Fei Feng 3, Lingxiao Ye 4, Aiping Zhang 5, Rui Fan	English	2021	207	Relational	Pittsburgh Sleep Quality Index (PSQI). Symptom Checklist 90 (SCL-90)	Scopus
Chuanxiao Li 1, Lijuan Huo 2, Ruoxi Wang 3, Ling Qi 4, Wenjia Wang 5, Xin Zhou 6, Yongjie Zhou 7, Xiangyang Zhang 8	English	2021	2201	Explanatory	Patient Health Questionnaire (PHQ-9)	Scopus
Jéssica Vertuan Rufino/Renne Rodrigues/Arthur Eumann Mesas/Camilo Molino Guidoni	Spanish	2024	2823 students	Correlational		Scielo
Jaquelini Betta Canever/Letícia Martins Cândido/Bruno de Souza Moreira/Ana Lúcia Danielewicz/Helena Iturvides	Spanish	2023	6,929 older adults	Description		Scielo

Cimarosti/Maria Fernanda Lima-Costa/Núbia Carelli Pereira de Avelar						
Cinthya Campos Salazar/ Luis Solano Mora/Mónica Salaza Villanea/Luis Ortega Araya/ David Johnson/ Yamileth Chacón Araya/José Moncada Jiménez	English	2022	52 urban and 30 rural older adults	Description	Sleep quality was measured using the Pittsburgh Sleep Quality Index	Scielo
Aysun Yuksel/Hulya Yilmaz-Onal/Berrak Basturk/Bahar Yalcin	English	2022	251 adults	Descriptive-explanatory	Pittsburgh Sleep Quality Index (PSQI)], the Depression, Anxiety, and Stress Scale (DASS	Scielo
Manuel Camino/Encarnación Satorres/Iraida Delhom/Elena Real/Mireia Abella/Juan C Meléndez	English	2022	106 subjects	Descriptive-correlational	Insomnia Severity Index criteria from the Diagnostic and Statistical Manual of Mental Disorders DSM-IV and the International Classification of Sleep Disorders	Scielo
Celia E. Mendiburu-Zavala/Cesar Pérez-Pérez/Pedro Lugo-Ancona/Ricardo Peñaloza-Cuevas/Enrique Pérez-Martínez	Spanish	2021	552 subjects young adults	Descriptive	Three questionnaires: Pittsburgh Sleep Quality Index (PSQI), Cohen's Perceived Stress Scale (PSS) and González's Painful Temporomandibular Disorders Examination Instrument (IEDTD)	Scielo
Élen dos Santos Alves/Sofia Cristina Iost Pavarini/Bruna Moretti Luchesl/Ana Carolina Ottaviani/Juliana de Fátima Zacarin Cardoso/Keika Inouye	Spanish	2021	150 elderly people	Descriptive-explanatory	characterization questionnaire, the Addenbrooke's Cognitive Examination-Revised (ACE-R), and the Pittsburgh Sleep Quality Index (PSQI)	Scielo
Suzimar de Fátima Benato Fusco/Stéfanie Cristina Pires Amancio/Ana Paula Pancieri/Maria Virginia Martins Faria/Wilza Carla Spiri/Eliana Mara Braga	English	2020	130 individuals	Correlational	State-Trait Anxiety Inventory, Binge Eating Scale, and Pittsburgh Sleep Quality Index.	Scielo

The studies reviewed show a clear predominance of relational or correlational and descriptive approaches, while experimental designs are scarce. This picture reflects a field of research focused mainly on the analysis of associations between variables, with less production of causal evidence. In terms of the instruments used, the Pittsburgh Sleep Quality Index (PSQI) has become the most widely used tool for assessing sleep quality, often complemented by other scales such as the Insomnia Severity Index (ISI), the Epworth Sleepiness Scale, the DASS-21, the Beck Depression Inventory (BDI), the Symptom Checklist-90 (SCL-90), and the Patient Health Questionnaire-9 (PHQ-9), among other self-report questionnaires that allow for the assessment of associated psychological dimensions.

Sample sizes vary widely, from studies with around 20 participants to research involving more than 10,000 subjects. This heterogeneity allows for both detailed descriptions in specific contexts and representative estimates at the population level. Studies with small samples tend to correspond to pilot trials or targeted interventions, while larger studies tend to explore general trends or risk factors.

There is also a tendency to co-measure psychological variables such as anxiety, stress, depression, well-being, and resilience, as well as habits related to sleep quality, such as nighttime eating or the use of electronic devices before bedtime. Taken together, the available evidence shows a consistent pattern of association between poorer sleep quality (lower PSQI scores) and poorer mental health. The diversity of geographical and population contexts in the studies reinforces the robustness of this link; however, the scarcity of experimental trials limits the possibility of establishing a direct causal relationship, underscoring the need for future research with designs that allow for verification of the directionality of the effect.

Table 3. *Ways of measuring "sleep quality"*

No.	Instrument
1	Pittsburgh Sleep Quality Index (PSQI), Brief Resilience Scale (BRS), Warwick-Edinburgh Mental Well-being Scale (WEMWBS).
2	Propensity Score (PS)
3	Depression, Anxiety, and Stress Scale-21: DASS-21, Pittsburgh Sleep Quality Index: PSQI
4	Digital mindfulness program
5	Pittsburgh Sleep Quality Index (PSQI)
6	Depression, Anxiety, and Stress Scales 21. Pittsburgh Sleep Quality Index
7	Sudarshan Kriya Yoga; SKY. Cognitive Processing Therapy [CPT]
8	Insomnia Severity Index. General Health Questionnaire 28. Perceived Stress Scale
9	Pittsburgh Sleep Quality Index (PSQI). LBPc.
10	Pittsburgh Sleep Quality Index (PSQI). Eating Attitudes Test-26 (EAT-26). Night Eating Questionnaire (NEQ). Beck Depression Inventory (BDI)
11	Online questionnaire
12	Pittsburgh Sleep Quality Index (PSQI). Epworth Sleepiness Scale. Beck Depression Index
13	Battery of self-report questionnaires and psychometrically valid and reliable paradigms
14	Youth@hordaland self-report questionnaires
15	Pittsburgh Sleep Quality Index (PSQI). Symptom Checklist 90 (SCL-90)
16	Patient Health Questionnaire (PHQ-9)
17	Sleep quality was measured using the Pittsburgh Sleep Quality Index
18	Pittsburgh Sleep Quality Index (PSQI)], the Depression, Anxiety, and Stress Scale (DASS
19	Insomnia Severity Index criteria from the Diagnostic and Statistical Manual of Mental Disorders DSM-IV and the International Classification of Sleep Disorders
20	three questionnaires: Pittsburgh Sleep Quality Index (PSQI), Cohen's Perceived Stress Scale (PSS), and González's Painful Temporomandibular Disorders Examination Instrument (IEDTD)

characterization questionnaire, the
and the Pittsburgh Sleep Quality Index (PSQI).

21 Pittsburgh Sleep Quality Index (PSQI)

22 State-Trait Anxiety Inventory, Binge Eating Scale, and Pittsburgh Sleep Quality Index.

In the literature reviewed, it is observed that the vast majority of studies use the Pittsburgh Sleep Quality Index (PSQI), both in its overall score and in its subscales, confirming its central role as a reference tool for assessing sleep quality. Also, the Insomnia Severity Index (ISI) is frequently used to assess the severity of insomnia, the Epworth Sleepiness Scale to measure daytime sleepiness, and various psychological scales such as the DASS-21, the Beck Depression Inventory (BDI), the Symptom Checklist-90 (SCL-90), and the Patient Health Questionnaire-9 (PHQ-9). Together, these tools allow for the creation of a psychosocial profile of poor sleep, integrating emotional, cognitive, and behavioral dimensions associated with sleep disturbance.

Likewise, several studies incorporate intervention strategies based on emotional regulation and mindfulness, including mindfulness (in face-to-face and digital formats), Sudarshan Kriya Yoga, and cognitive-behavioral psychological therapies (CBT). These techniques have shown positive effects both in improving sleep indicators and in reducing affective symptoms, demonstrating their therapeutic potential in the comprehensive treatment of sleep disorders.

However, the current literature is characterized by a predominance of subjective measures based on self-reports and limited use of objective metrics, such as those obtained through wearables or actigraphy. This methodological barrier presents an important opportunity for future studies, which would promote understanding of the phenomenon by incorporating activity monitors and clinically validated sleep parameters, providing access to more accurately correlate physiological indicators with psychological perceptions and mental health outcomes.

Table 4. Variables associated with "Sleep Quality"

No.	Variable name	Included in number of articles
1	Psychological resilience	1
2	Mental well-being	2
3	Anxiety	3
4	Stress	2
5	Mental health	3
6	Social media addiction	1
7	Depression	1
8	Cognitive therapy	1
9	Cognitive performance	1

In the set of studies reviewed, anxiety and mental health appear as the most recurrent themes in relation to sleep quality, followed by equally relevant variables such as stress and depression. These findings show a stable pattern linking poor sleep with an increase in indicators of psychological distress, reaffirming the close connection between emotional processes and sleep regulation. At the same time, the constructs of resilience and mental well-being are reported as protective factors associated with better rest or less sleep disturbance, suggesting their role as

psychological resources that promote adaptation and emotional balance in the face of daily demands.

In terms of interventions and functional correlates, cognitive therapy—particularly cognitive-behavioral therapy—stands out as an effective strategy for improving sleep quality, while variables such as cognitive performance and social media addiction reveal significant links between sleep, academic or work performance, and contemporary digital habits. These results underscore the need to approach rest from a comprehensive perspective that considers not only symptoms but also behaviors associated with modern lifestyles.

In summary, the predominant explanatory model is biopsychosocial in nature, where poor sleep is associated with a greater burden of negative affect and elevated levels of stress, while personal resources—such as resilience—and cognitive-behavioral strategies are configured as modulating factors that cushion the psychological impact of poor sleep. This integrative approach allows us to understand sleep quality as a complex phenomenon, determined by the interaction between biological, emotional, and social processes.

The evidence reviewed shows a predominance of relational and correlational studies, in which the Pittsburgh Sleep Quality Index (PSQI) is the central instrument for assessing sleep quality. These studies, which represent the majority of the analyzed corpus, agree in pointing out positive associations between poorer sleep quality (high PSQI scores) and higher levels of anxiety, stress, and depression, as well as negative relationships with psychological well-being and resilience. The robustness of these findings is reinforced by the generally large sample size and the consistency of the pattern across different population contexts, which contributes to high external validity. However, the cross-sectional designs used limit causal inferences, opening up the possibility of bidirectionality in the relationship: poor sleep can exacerbate emotional distress, while distress and stress can impair sleep quality. In addition, the frequent presence of behavioral comorbidities—such as nighttime eating or prolonged screen use—suggests the existence of shared chronobiological and behavioral mechanisms that mediate this interaction.

In the case of descriptive studies conducted in the general population and older adults, the results confirm high prevalences of sleep disturbances in the post-pandemic period, highlighting the influence of psychosocial and contextual factors such as the environment, daily routines, and differences between urban and rural areas. Although these studies do not usually address longitudinal changes, their contribution is key to identifying risk profiles—for example, daytime sleepiness, prolonged latency, or low sleep efficiency—and to guiding the design of community interventions aimed at promoting healthy rest.

On the other hand, intervention studies—particularly those evaluating mindfulness programs (including their digital versions), Sudarshan Kriya Yoga (SKY), and cognitive-behavioral psychological therapies (CBT)—although less numerous and often with small samples, provide encouraging evidence. In general, they show significant improvements in sleep indicators and affective states, especially through the reduction of stress and anxiety, which offers a plausible mechanistic route to explain the observed improvement. However, the strength of the evidence is attenuated by methodological limitations, such as the absence of robust control groups in certain trials and the exclusive reliance on self-reports, which restricts the generalizability of the results.

In relation to experimental evidence and the use of objective measurements, there is a shortage of randomized controlled trials (RCTs) and low incorporation of objective recording technologies, such as activity monitors or actigraphy, that allow for the estimation of key variables (latency, efficiency, nighttime awakenings, or sleep regularity). This methodological shortcoming prevents us from concluding that the use of monitoring devices per se improves sleep quality. The current literature is mainly limited to linking subjective sleep quality scores with psychosocial variables.

To respond more accurately to questions in the field, it will be necessary to implement controlled trials comparing interventions with and without the use of monitors, including behavioral feedback, objective outcomes, and follow-ups of at least 8 to 12 weeks.

Finally, qualitative interpretive synthesis allows us to outline a coherent and robust biopsychosocial model. Sleep not only reflects a person's emotional state and coping resources, but also dynamically co-constructs them, shaping a feedback process between body, mind, and environment. The effective interventions identified tend to modulate stress and anxiety levels while strengthening psychological resources such as resilience, sleep hygiene, and emotional regulation. In this context, technology—particularly monitoring devices—could act as a valuable mediator if integrated into cognitive-behavioral or digital health programs, although current evidence does not yet conclusively demonstrate its direct impact on sleep quality. In short, the field is moving toward a more integrative understanding, but it requires greater experimental rigor and triangulation of subjective and objective measures to consolidate its empirical basis.

Conclusions

The results analyzed confirm that there is a solid model of the relationship between poor sleep quality and higher levels of anxiety, stress, and depression, while variables such as resilience and psychological well-being are shown to be protective factors that mitigate the negative effects of poor sleep. This result reaffirms the biopsychosocial nature of sleep, in which emotional, cognitive, and behavioral dimensions interact dynamically to constitute the experience of rest.

The Pittsburgh Sleep Quality Index (PSQI) is established as the standard assessment tool in the specialized literature; however, it is suggested that complementary scales such as the Insomnia Severity Index (ISI) and the Epworth Sleepiness Scale be added, along with objective metrics obtained through actigraphy or wearable devices. This methodological triangulation would strengthen the validity of the measurements and allow for a more accurate capture of the interaction between subjective perception and physiological indicators of sleep.

Interventions based on digital mindfulness, breathing techniques such as Sudarshan Kriya Yoga (SKY), and cognitive-behavioral therapies (CBT) show promising results in improving sleep quality, mainly through the reduction of negative affect and stress. However, the available evidence is still based on studies with methodological limitations, so further research is needed with randomized controlled trials (RCTs) to confirm the causal efficacy of these strategies.

Despite growing interest in the topic, few studies have experimentally examined the impact of sleep monitors or tracking devices on sleep quality. Future research should design RCTs that integrate behavioral feedback based on monitor data, combining objective and subjective outcomes and considering follow-up periods of at least 8 to 12 weeks, in order to obtain conclusive and reproducible evidence.

Finally, the results suggest that integrated programs combining the use of monitors with sleep hygiene and emotional regulation strategies could maximize benefits and improve adherence to interventions, particularly in adults exposed to high levels of post-pandemic stress. It is also recommended to prioritize experimental designs with Latin American samples, incorporate subgroup analyses (by sex, age, chronotype, and urban/rural context), and evaluate the cost-effectiveness of technology-supported interventions, with the aim of advancing toward sustainable and culturally adapted solutions that promote sleep health and mental well-being in the region.

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Academic integrity and artificial intelligence in Latin American higher education

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Introduction

Academic integrity is a fundamental pillar of educational quality and the credibility of higher education institutions. It is understood as the honest, responsible, and fair behavior of all members of the academic community, including students, faculty, and professional and administrative staff, in learning, teaching, and research processes (International Center for Academic Integrity [ICAI], 2021). A university culture based on integrity ensures that norms and values promote honesty and that fraud is the exception rather than the rule (Bertram Gallant & Drinan, 2008; ICAI, 2021) The study of academic integrity has only gained relevance in recent decades (Escudero-Nahón & López-Quiroz, 2019), reflecting a growing concern to curb dishonest behavior such as plagiarism, cheating on exams, falsification of data, and other forms of academic fraud.

Numerous data underscore the magnitude of the problem. Internationally, various studies have reported that an alarming proportion of students have engaged in academic cheating at least once during their education. In self-reported studies with multidisciplinary undergraduate samples, the figures are high: in Australia, 81% of students reported having committed plagiarism in their work, 41% had cheated on exams, and 25% had falsified data at least once (Marsden, Carroll, & Neill, 2005). Findings in other contexts show similar values: for example, 66.1% of university students report plagiarism (Liu, 2023), and comparative analyses between schools confirm that plagiarism is one of the most frequent methods of dishonesty in unsupervised tasks across disciplines (Khalid, 2015).

Associated factors include anxiety, academic overload, pressure to get good grades, and lack of skills in proper citation (Araya et al., 2023). Although there has been greater awareness in recent years about the seriousness of plagiarism and its consequences (Escudero-Nahón & López-Quiroz, 2019; Morales Montes & Lujano Vilchis, 2021), misperceptions and attitudes that normalize cheating persist.

In contexts where social corruption is widespread, some students come to see academic cheating as almost acceptable or necessary in order to "get ahead" (Contreras-Pacheco et al., 2023). The colloquial notion of "where there's a rule, there's a loophole" resonates in certain institutional cultures, fueling the idea that obtaining a university degree (linked to the desire for a professional career, status, and future income) justifies unethical shortcuts (Contreras-Pacheco et al., 2023; Bertram Gallant & Drinan, 2008). The COVID-19 pandemic exacerbated these trends: the massive transition to online education and hyperconnectivity facilitated dishonest behavior, with an increase in plagiarism and copying during 2020-2021 in various educational settings (Villalobos-González, Herrera-Núñez, & Delgado-Montoya, 2025).

This scenario poses serious risks. Academic dishonesty not only compromises the individual educational process, but also *"damages the quality of education and society's trust"* in graduate professionals (ICAI, 2021, p. 4). Maintaining high standards of integrity during university education is critical to ensuring that, upon graduation, professionals act ethically in their fields of work (ICAI, 2021). This is especially relevant in disciplines whose graduates will be responsible for the well-being of individuals or communities (e.g., health professionals, educators, engineers, among others), where dishonest habits could have harmful consequences for society (Araya et al., 2023; Villalobos-González, Herrera-Núñez, & Delgado-Montoya, 2025).

Historically, higher education institutions have combated academic dishonesty with a variety of approaches. In Latin America, many universities have incorporated values of honesty and rigor into official documents such as missions, visions, codes of ethics, or educational models, but until recently, few had fully developed explicit academic integrity policies (Escudero-Nahón & López-Quiroz, 2019; Moya, 2023). Previous studies show a gap between developed and developing countries in this area: while Anglo-Saxon nations have for years implemented codes of honor, robust plagiarism detection systems, and integrity committees, in much of Latin America such measures have been incipient or partial (Bretag et al., 2011; Moya, 2023). A systematic review of the specialized literature highlighted the lack of comprehensive models to prevent and punish academic dishonesty in Latin American higher education (Escudero-Nahón & López-Quiroz, 2019). In particular, it noted that the issue had been virtually ignored at the postgraduate level, lagging behind despite its strategic importance (Escudero-Nahón & López-Quiroz, 2019). The absence of a systemic approach has meant that compliance with integrity often falls to the discretion of faculty, with sanctions applied on a case-by-case basis and criteria that are not always uniform (Morales Montes & Lujano Vilchis, 2021). This regulatory and institutional vacuum opens the door to impunity and ambiguous messages about what behaviors are tolerable.

In recent years, however, a movement to strengthen academic integrity has emerged in the region. Pioneering universities have begun to implement codes of honor and awareness campaigns, promoting a shift from a purely punitive approach to preventive and educational approaches (Bretag et al., 2011; ICAI, 2021). For example, in 2016, the Pontifical Catholic University of Chile adopted an institutional Code of Honor and, in 2022, established a comprehensive protocol for managing breaches of academic integrity with an educational focus, where sanctions are accompanied by reflection and learning on the part of the offender (Pontifical Catholic University of Chile [UC Chile], 2023). Similarly, in Mexico, public universities have incorporated anti-plagiarism guidelines into their regulations: a documentary analysis of 33 Mexican public universities found that virtually all of them include provisions to prevent and punish plagiarism in their internal regulations (Morales Montes & Lujano Vilchis, 2021). However, major challenges remain in translating regulations into effective practices and everyday culture. Many teachers report feeling ill-prepared to detect and handle incidents of dishonesty (Morales Montes & Lujano Vilchis, 2021), and have traditionally had to rely on tools such as anti-plagiarism software and the threat of sanctions to deter cheating (Bretag et al., 2011). At the same time, studies suggest that coercive approaches alone are not enough; it is necessary to establish a culture of integrity rooted in positive values and the genuine conviction of students and teachers (Cotton et al., 2023; ICAI, 2021).

Amid this challenging context, the rapid emergence of new digital technologies is changing the rules of the game. In particular, the emergence of generative artificial intelligence systems has caused an "earthquake" in the field of education. AI tools capable of producing coherent text in seconds, such as OpenAI ChatGPT, released to the public in late 2022, have set off alarms about new forms of academic cheating. Now, a student can generate original essays, reports, or even programming code with just a few brief prompts, bypassing traditional plagiarism detection

based on textual matches. In other words, it is possible to obtain an "unpublished" work without having actually learned or worked on its creation. This ease threatens to profoundly undermine academic integrity by "generating falsified content" that simulates legitimate student production (Stokel-Walker & van Noorden, 2023; van Dis et al., 2023). Institutions around the world have reacted with confusion: some initially banned the use of ChatGPT because they considered it a form of cheating, while others have chosen to integrate it pedagogically by setting clear limits on its use (Cotton et al., 2023; UNESCO IESALC, 2023).

Given this situation, and considering the structural and cultural particularities of South America, it is essential to understand the impact, identify risks and opportunities, and guide institutional responses that balance innovation and honesty. Therefore, this chapter seeks to "examine the effect of generative artificial intelligence on academic integrity in Latin American higher education and, based on a regional diagnosis, formulate pedagogical and public policy recommendations to strengthen a culture of honesty."

Academic Integrity and AI in Higher Education

Academic integrity, as noted, encompasses a set of values such as honesty, trust, justice, respect, responsibility, and courage, which should guide academic work (ICAI, 2021). It involves conducting evaluations, assignments, and research in a transparent and responsible manner, acknowledging the corresponding authorship and avoiding any form of deception or unfair advantage. In the Latin American context, academic integrity faces particular challenges. On the one hand, in some environments, academic cheating has become somewhat normalized, influenced by cultural and systemic factors: high levels of corruption and nepotism in society, extreme pressure to achieve social advancement through a university degree, or deficiencies in students' prior training in ethics and citation (Contreras-Pacheco et al., 2023; Morales Montes & Lujano Vilchis, 2021). These conditions can lead students to perceive plagiarism or copying not as serious offenses, but as pragmatic strategies for passing courses in highly competitive environments.

On the other hand, the literature suggests that higher education institutions in the region themselves have not always provided strong responses. Escudero-Nahón and López-Quiroz (2019) highlight the absence of comprehensive models for the prevention and punishment of academic fraud in Latin America. Traditionally, measures have focused on punishing individual cases (when detected) rather than systematically preventing dishonest behavior. In addition, many university regulations have been ambiguous or lax: until recently, terms such as "academic integrity" did not appear explicitly in the regulations of several universities, although specific acts such as plagiarism or identity theft were prohibited (Morales Montes & Lujano Vilchis, 2021). This fragmented approach has resulted in implementation gaps: even if there is a prohibition on plagiarism on paper, in practice, teachers and students may be unaware of the scope of this rule or lack the resources to enforce it.

A common finding is the lack of preparation and support for teachers. Several studies in the region indicate that many teachers do not feel equipped to deal with cases of academic dishonesty (Morales Montes & Lujano Vilchis, 2021). Gottardello and Karabag (2020) reported that teachers are often unaware of effective techniques for detecting plagiarism beyond their intuition or basic tools, and fear facing disputes or not being supported by their institutions when reporting violations. This can lead some to choose to ignore or minimize offenses, perpetuating a culture of impunity. A study conducted in Mexico with 532 high school and higher education teachers revealed interesting perceptions: teachers tended to evaluate the integrity of their colleagues and themselves more positively than that of their students. In other words, there is a

certain mistrust of students' honesty, combined with a self-image of greater rectitude. This "trust gap" can hinder open dialogue about integrity. However, the same study concluded with clear recommendations: there is an urgent need to develop more robust institutional policies, offer common ethics training for teachers and students, promote collaborative work and spaces for discussion on integrity, in order to build a shared professional ethos that discourages dishonest behavior (Morales Montes & Lujano Vilchis, 2021).

Another key conceptual aspect is the punitive vs. formative approach to addressing academic dishonesty. The traditional approach has focused on defining sanctions for those who commit offenses: from zero grades and course failure to suspensions or expulsions in serious cases. While a system of consequences is necessary to deter and set boundaries, recent research suggests that punishment alone has limited effects on creating a culture of integrity. Bretag et al. (2011) propose complementing "detection and punishment" with a holistic approach that includes education, prevention, and cultural change. In line with this, experts such as David Rettinger (former president of the ICAI) emphasize that isolated punitive approaches "do not work" in achieving academic integrity and that it is more effective to instill intrinsic values and motivations in students (ICAI, 2021). This involves actively teaching about integrity (what it is, why it matters), developing academic skills (writing, citation, critical thinking) that empower students to work honestly, and redesigning assessment environments that reduce the temptation to cheat, since, in addition, many cases of plagiarism or copying are due more to ignorance of the rules and lack of skills than to a deliberate intention to deceive (Araya et al., 2023).

In summary, the Latin American context in terms of academic integrity is characterized by: (a) a growing recognition of the problem and its ethical and professional implications; (b) incipient but important efforts to develop institutional policies, codes of honor, and protocols for action; (c) tensions between punitive and educational approaches; (d) the need to involve the entire academic community in building a culture of honesty, from authorities to students. With this foundation laid, it is now possible to incorporate the new disruptive variable into the analysis: Artificial Intelligence.

Generative artificial intelligence and its implications for education

Artificial intelligence (AI) refers, in general terms, to computer systems capable of performing tasks that would typically require human intelligence, such as learning, reasoning, or decision-making. In the field of education, AI has already had various applications: intelligent tutors, automated assessment systems, learning analytics, etc. However, the emergence of generative AI models in late 2022 marked a turning point. These tools can produce original texts in natural language from a simple instruction, producing everything from short answers to complete essays, computer code, translations, or summaries. Their open availability and ease of use (all you need is Internet access) led to their explosive adoption: in a matter of months, millions of people around the world (including students) began using them for all kinds of purposes. For example, it was reported that in early 2023, nearly 30% of college students in a U.S. survey had used ChatGPT for some academic task, and another global study estimated that 70% of students had tried these tools in their studies (Cotton et al., 2023; UNESCO IESALC, 2023; Stokel-Walker & van Noorden, 2023; van Dis et al., 2023). Although the figures vary between contexts (some secondary school studies found no significant increase in plagiarism following the popularization of AI), it is undeniable that the possibilities for academic fraud are multiplied with publicly accessible generative AI systems (Chen et al., 2024; Cotton et al., 2023).

The forms of dishonesty enabled by AI can be diverse. The most direct is the generation of academic texts (essays, reports, answers to questions) by an AI model, which the student then presents as their own. Unlike traditional plagiarism (where the work of another student or existing source is copied), here the text is new, so it does not appear in search engines or anti-plagiarism databases. In essence, the student would be outsourcing their intellectual work to a machine, which undermines the principle of authenticity in learning. Another method is to use AI to rephrase or translate other people's texts, circumventing plagiarism detectors (for example, taking an article in English and asking the AI to deliver it in Spanish with original wording). There is also the case of using AI to obtain immediate answers in online assessments or homework assignments, instead of solving the problems personally. All of these practices fall under the umbrella of AI-assisted academic dishonesty, equivalent to cheating using "virtual collaborators."

Educational institutions have expressed concern about this unprecedented phenomenon. An international survey of university teachers showed ambivalent perceptions, although alarm predominated: many see it as a threat to the integrity of assessments, as it facilitates copying and reduces personal effort (UNESCO IESALC, 2023). Without clear frameworks, the question arises as to whether it is appropriate to speak of plagiarism when the text does not come from a human author, but from a machine.

In the absence of initial guidelines, some Latin American universities reacted by banning the use of ChatGPT in academic work, equating it with a lack of integrity. However, this stance has been giving way to more nuanced approaches: an absolute ban is unrealistic and even counterproductive, as it deprives students and teachers of potential benefits (Cotton et al., 2023; UC Chile, 2023; UNESCO IESALC, 2023).

AI can also be used for legitimate purposes, such as obtaining additional explanations, improving the grammar of a text, generating code base for analysis, or supporting the personalization of learning (Salas-Pilco & Yang, 2022; Eaton et al., 2024). Hence, the current discussion focuses on how to regulate its use to support learning without compromising academic integrity, while taking advantage of its contributions to student retention and administrative optimization (Salas-Pilco & Yang, 2022; Beale, 2025).

This has given rise to two main approaches: one restrictive and the other integrative. The restrictive approach advocates establishing clear rules that limit or control the use of AI in student work, with penalties for those who use it without authorization. This includes updating academic integrity regulations by adding specific provisions on "unauthorized use of AI tools" as a form of fraud (Morales Montes & Lujano Vilchis, 2021). Additionally, companies such as Turnitin have developed AI-generated text detectors, which have been incorporated into task management platforms. Turnitin claimed that its detector introduced in 2023 can identify AI-written content with high accuracy, although users and experts have reported cases of false positives (Turnitin, 2023). In any case, the mere availability of detectors reflects a technological response to the problem, aligned with the restrictive approach: if the student uses AI in secret, we will try to catch that cheating using reverse AI. This approach, however, faces significant limitations. On the one hand, AI detectors are not infallible; models evolve (e.g., new versions of ChatGPT, or automated paraphrasing tools) and can escape detection, or worse, mistakenly flag genuinely human texts as "generated." On the other hand, a total surveillance environment can generate ethical and practical tensions: to what extent should student work be monitored? Some universities have expressed reservations about intensive use of these detectors because of the risk of unfair accusations and the harmful effect on the pedagogical relationship.

The integrative approach, meanwhile, proposes incorporating AI as an ally in education, teaching students to use it ethically and creatively, while redesigning academic activities to preserve integrity. Authors such as Cotton et al. (2023) suggest that the arrival of ChatGPT is an opportunity to rethink assessment strategies: if an exam or assignment can be solved entirely by AI, perhaps that assessment tool is no longer valid for measuring deep learning. It is therefore recommended to move towards more authentic, personalized, and difficult-to-automate assessments. For example, reflective essays linked to personal experiences, oral defenses, collaborative projects, use of cross-checking tools, etc. In this way, human added value (creativity, criticism, contextual application) regains centrality. Likewise, students are encouraged to declare their use of AI when they employ it as a support, similar to citing a bibliographic source (UNESCO IESALC, 2023). For example, some teachers allow their students to consult ChatGPT for ideas, as long as they indicate in an appendix what questions they asked and how they integrated the answers, critically evaluating their quality. This transparency transforms the use of AI into part of the learning process rather than a hidden trap (Avello-Sáez, Lucero-González, & Villagrán, 2024).

Examples of this integrative approach are already emerging in Latin America. Higher education institutions have already released guidelines for the use of ChatGPT that include advice for teachers on how to design activities considering AI, how to discuss the limits of its use with students, and how to encourage its responsible use (Universidad de Las Américas, 2023; UC Chile, 2023). These guidelines emphasize that teachers can, for example, request initial handwritten drafts or include oral components to complement written work, so that students can demonstrate authorship. They also suggest using ChatGPT as a pedagogical tool: to generate discussion questions, to simulate scenarios, or for students to verify explanations. In all cases, the focus is on honesty and self-regulation: students must understand that resorting to AI to avoid intellectual effort impoverishes their own learning and constitutes an ethical breach if concealed.

From an ethical perspective, the use of AI in academic contexts raises questions about authorship and authenticity. Traditionally, authorship in academic work implies that the ideas and words expressed are the product of the intellect of the person who signs the work (except for quotations clearly attributed to others). With generative AI, the line is blurred: the text is new, but it does not come directly from the student's intellect, even if the student formulated the instruction. Some philosophers of education point out that delegating the creation of work to AI breaks the educational contract, as the student ceases to be the author of their own learning. Even if there were no "victim" of plagiarism in terms of copying another author, there would be a betrayal of oneself and the educational process. In addition, there is concern about the erosion of cognitive skills: according to certain studies, over-reliance on AI tools could diminish students' critical thinking, writing, and problem-solving abilities in the long term (Chen et al., 2024; Cotton et al., 2023). Indeed, there are warnings that dependence could atrophy both cognitive and socio-emotional skills (capacity for deep analysis, perseverance, interpersonal communication) (UNESCO IESALC, 2023). This reinforces the argument that academic integrity is not only a moral issue, but also a matter of preserving the educational purpose of academic activities. Finally, it is worth mentioning that the adoption of AI also raises new equity dilemmas. Not all students have the same access to these tools or the same level of digital literacy to use them effectively. In Latin America, digital divides could mean that some students cheat with AI because they have more resources, while others, even if they want to, cannot do so. Thus, total permissiveness without control could increase unfair inequalities. Similarly, in the absence of guidance, less aware students could fall into misuse without even considering that they are doing wrong (for example, thinking that "*if the application gave me the answer, why not use it verbatim?*"). Hence the importance of educating students in digital integrity: including in citizenship training or cross-

curricular skills content notions about technology ethics, honest use of information, and now also honest use of artificial intelligence (UNESCO IESALC, 2023).

By way of transition, we can affirm that the interaction between academic integrity and artificial intelligence is complex and multidimensional. It offers tangible threats, such as novel forms of fraud, but also opportunities to rethink and improve teaching practices. Everything will depend on the responses we deploy. Below, we will examine how three Latin American countries (Chile, Colombia, and Mexico) are dealing with these challenges, both through institutional policies and practical initiatives.

Policies and Initiatives in Response to AI: Case Studies in Chile, Colombia, and Mexico

To frame the case studies, it is useful to first locate the ICAI's Latin American Academic Integrity Network. This is a collaborative network that supports institutions and professionals in the region in building a culture of integrity, with four central purposes: (a) to share resources and disseminate good practices, (b) to offer training and professional development for students, teachers, and support teams, (c) supporting the institutional efforts of those who lead integrity on their campuses, and (d) strengthening research networks in academic integrity. The network maintains information repositories, free induction courses (for students and teachers), as well as a history of conferences, seminars, and webinars, and regional contact channels that facilitate collaboration and knowledge transfer. In short, it operates as a Latin American hub for resources, training, and community of practice, useful for guiding institutions that want to begin their journey toward incorporating academic integrity [ICAI], 2025).

Case Study: Chile: Incipient Development and Institutional Training Approach

In Chile, the institutionalization of academic integrity has seen recent but steady progress. Traditionally, universities included values such as honesty and responsibility in their educational programs and ethics courses, although they lacked specific policies (Moya, 2023). Over the last decade, global influences and local incidents have driven a shift toward more structured frameworks.

A key milestone was the leadership of the Pontifical Catholic University of Chile (UC), which in 2016 established a Code of Honor and, in 2022, an institutional protocol for managing misconduct. This is characterized by a formative approach: in addition to sanctions, it includes pedagogical measures such as writing workshops or mentoring, with the aim of providing students with tools to strengthen their academic practice (UC Chile, 2023).

The emergence of artificial intelligence found Chile in this process of consolidation. The UC has promoted a strategy of reflection and training, which includes online resources, awareness campaigns, and specific guidelines on the responsible use of AI. Other universities, such as the University of Las Américas, have developed teaching guidelines that balance restrictions with teaching the ethical use of these tools (University of Las Américas, 2023).

Empirical evidence reflects persistent challenges: academic overload, competitiveness, and lack of clarity about what constitutes plagiarism continue to be factors that encourage dishonest behavior (Araya et al., 2023). Virtual education during the pandemic also exposed weaknesses,

leading to adjustments in assessments (Villalobos-González, Herrera-Núñez, & Delgado-Montoya, 2025). In response, universities have adopted anti-plagiarism technologies and revised their assessment strategies, now favoring more authentic approaches over excessive surveillance.

In summary, Chile is moving from a general ethical approach to clearer and more formative institutional policies, while incorporating the challenge of AI as a central part of the discussion on academic integrity.

The case of Colombia: Ethical reflections and initial measures in response to AI

In Colombia, there are explicit provisions against plagiarism and academic dishonesty in student regulations, as evidenced by clauses in universities such as the Pontificia Universidad Javeriana and the Universidad Piloto de Colombia. However, the challenge remains of evolving from a predominantly punitive approach to comprehensive strategies for a culture of integrity that combine prevention, training, and clear procedures (Pontificia Universidad Javeriana, 2011; Universidad Piloto de Colombia, 2022).

A relevant line of work links academic integrity and citizenship. In a quasi-experimental study with university students, it was shown that reflecting on the relationship between dishonest acts in the classroom and social corruption increases awareness of the seriousness of these behaviors and opens space for educational interventions beyond punishment (Contreras-Pacheco, Mosquera-Navarro, & Martínez-Ardila, 2023).

With the emergence of generative AI, the Colombian debate has focused on responsible regulation rather than prohibition: making the status of AI use explicit in each assessment, requiring traceability of the process (drafts, logs, oral defenses), and strengthening the ethical and digital literacy of teachers and students. These measures are in line with international recommendations that suggest combining adjustments to assessment, training, and institutional policies to safeguard authorship and academic honesty (UNESCO, 2025).

The case of Mexico: Regulatory consolidation and regional leadership in academic integrity

Mexico has been one of the most active Latin American countries in the area of academic integrity in recent years. In terms of university policy, an analysis of 33 Mexican public universities showed that virtually all of them include provisions to prevent and punish student plagiarism (Morales Montes & Lujano Vilchis, 2021). While there are variations in definitions and procedures, the trend has been toward greater formalization and clarity.

Mexican leadership is also reflected in specialized networks and conferences. The University of Monterrey (UDEM, 2025) has hosted numerous editions of the Academic Integrity Conference, with the participation of regional experts. With regard to AI, several institutions (e.g., Tecnológico de Monterrey) issued guidelines in 2023 that consider the unauthorized use of AI to be a violation of student ethics, while promoting the responsible integration of AI into educational processes. In public universities, guidelines have been disseminated to redesign assessments (staggered submissions, random oral defenses) and to declare the use of AI when appropriate.

In online programs, a recent study found that students perceive a greater temptation to rely on external resources (translators, assignment banks, text bots), intensified by the emergence of AI, which reinforces the need for induction in integrity and verification of authorship (Velázquez García et al., 2025).

The convergence of academic integrity and artificial intelligence presents a complex scenario, fraught with tensions but also opportunities that deserve reflection:

Punitive approach vs. educational approach: A first contradiction identified is the tension between continuing to reinforce traditional punitive mechanisms versus migrating toward more educational and preventive approaches. Evidence suggests that punishment alone is not enough to build a sustainable culture of integrity (Bretag et al., 2011; International Center for Academic Integrity [ICAI], 2021; Pontificia Universidad Católica de Chile [UC Chile], 2023). Both in Chile (UC) and in shared experiences from Mexico and Colombia, the value of formative strategies has been demonstrated: protocols that combine punishment with learning, ethics workshops for offenders, etc.

This theoretical-empirical shift is based on the notion that dishonest behavior often stems from educational failures (lack of knowledge, lack of skills) rather than malicious intent. Therefore, the most effective response includes educating students so that they understand the reason for the rule and acquire the tools to comply with it. That said, a paradox also emerges: in surveys, most teachers say they prefer an educational approach over a punitive one, but at the same time they point to practical obstacles (workload, lack of institutional support, fear that being lenient will weaken discipline) (Alsharefeen & Al Sayari, 2025; Frontiers in Education, 2025).

It is therefore necessary to balance both approaches. A new interpretive framework could be a "restorative approach" to academic integrity, inspired by restorative justice: when faced with a wrongdoing, not only punish the guilty party, but also make them repair the damage (for example, by apologizing if they cheated on a group assignment, or redoing the work correctly) and reintegrate them into the academic community with a reinforced commitment. This transforms the wrongdoing into an opportunity for moral learning, aligning the consequences with the formation of values. Latin American institutions can explore this perspective as a complement to existing disciplinary structures (Bretag et al., 2011; UC Chile, 2023).

Cultural gaps and inequalities: The cases analyzed confirm that academic integrity does not occur in a vacuum, but is embedded in specific socio-cultural contexts. The normalization of cheating correlated with environments of corruption (as reported in the intervention in Colombia) suggests that to achieve real change, universities must also work on cultural aspects with their students. This is not trivial: it requires frank dialogues about ethics, scientific integrity, social responsibility, etc. At the same time, the incorporation of AI opens a digital divide: students with greater access and technological expertise could gain an unfair advantage over their less familiar peers. This internal inequality jeopardizes the principle of academic equity.

A student in a rural area may not even know about ChatGPT, while a bilingual student in an urban area may use it extensively. Latin American universities must be aware of these disparities when designing policies. One proposal could be to institute AI literacy programs for all students, so that they acquire basic skills in its use and understanding of its ethical implications.

This not only levels the playing field, but also integrates AI into the curriculum in a positive way, reducing the incentive to use it secretly (Contreras-Pacheco et al., 2023; UNESCO IESALC, 2023).

Impact of AI on the perception of integrity: A notable finding is the apparent discrepancy in data regarding the increase (or lack thereof) in dishonesty after ChatGPT. While some initial studies in secondary contexts do not see a dramatic jump, others in specialized university contexts (programming) do detect significant increases. This apparent contradiction can be interpreted in light of different contexts: perhaps in standardized assessments with closed-ended questions (such as in secondary school), AI does not contribute as much, or students have not yet fully integrated it, but in more open-ended or technical tasks (programming, essays), its effect is greater. In any case, this leads us to conclude that the risk of AI-assisted dishonesty is real but variable. We cannot generalize that "everyone will cheat with AI," but neither can we minimize obvious cases where it is happening.

The theoretical challenge is to develop a framework that allows us to predict where AI could further erode integrity and where, on the contrary, it could improve the quality of learning. For example, perhaps in simple memory or basic writing tasks, AI represents a great temptation to copy, while in creative projects its role is more helpful. Understanding these dynamics would help focus efforts (by designing stronger interventions in areas of greater risk).

Here, we propose adopting an academic risk management approach: similar to how plagiarism risk is assessed according to the type of assessment (e.g., take-home exams vs. in-class exams), incorporate the variable "ease of resolution by AI" as a risk factor and mitigate accordingly. A new concept could be that of an *"AI vulnerability index"* for academic tasks, which combines the probability of AI resolution with the importance of the task, allowing teachers to redesign or reinforce supervision where that index is high (Chen et al., 2024; Cotton et al., 2023; UNESCO IESALC, 2023).

Agile and updated policies: A cross-cutting issue is the need to update academic integrity policies to explicitly address the phenomenon of AI. Many institutions still lag behind in terms of regulations: rules that refer to "*not copying from books or the Internet"* but say nothing about the use of algorithms or generative software. The absence of mention can create gray areas that make it difficult to act when cases arise. The universities analyzed are in the process of updating their policies, but it is crucial that they do so with great care. A simple generic prohibition could fall short or be unenforceable; the best approach is to develop policies in dialogue with the academic community so that they are realistic and accepted. Furthermore, they should be agile: technology evolves rapidly, and rules must be able to be revised more frequently than before. Perhaps they should include flexible clauses such as "any use of emerging technology that unfairly substitutes for student work will be considered misconduct," followed by examples that can be expanded upon.

The theoretical discussion here is how to make rules general enough to cover future innovations, but specific enough to provide certainty. A related recommendation is that institutions form permanent committees on academic integrity and technological innovation, made up of ethics experts, teachers, and students, responsible for monitoring these issues and proposing periodic regulatory updates. This would allow for a proactive rather than reactive approach (Moya, 2023; UC Chile, 2023).

Role of teachers as street-level bureaucrats: Interestingly, teachers are on the front line of implementing integrity policies (in English, they have been likened to "street-level bureaucrats" in the context of integrity, due to their discretion in applying rules). The study in the United Arab Emirates (Alsharefeen & Al Sayari, 2025) highlighted that teachers face extra burdens, lack of support, and ambiguity when dealing with traditional plagiarism and AI. This is also seen in Latin America: much is expected of teachers (to monitor, deter, report), sometimes without providing

them with sufficient training or support. For any new interpretive framework to work, teachers must be empowered allies, not exhausted police officers. This means offering them ongoing training in academic integrity and AI, recognizing their work in this area (for example, considering it in performance evaluations), and providing clear channels for handling cases (legal or psychological counseling if they receive challenges, etc.).

One possible framework is to adopt the view of teachers as "mentors of integrity" rather than watchdogs. This emphasizes their formative role: they guide students toward honesty, give them feedback when they make mistakes, and contribute to designing fair learning environments (Frontiers in Education, 2025; UNESCO IESALC, 2023).

Opportunities for AI to strengthen integrity: Although it may sound counterintuitive, AI not only poses threats, it also offers opportunities to improve integrity and educational quality. Several possibilities have been proposed in the global discussion: using AI to detect inconsistencies in work that reveal dubious authorship; using AI to generate multiple versions of exams (as in institutional developments reported in the region), making copying more difficult; and even AI as a personalized tutor to help students better understand the material, reducing their need to cheat. Ethical integration of AI could, in theory, reduce the incidence of cheating motivated by anxiety or lack of preparation, as students with AI would have more support for learning (if used properly). This requires a change in approach: AI as an ally of honest learning.

A concrete example: some programming courses have incorporated ChatGPT as a permitted tool but with a pedagogical twist, in which students can ask AI for help but must then comment on the resulting code line by line in their own words and show that they understand it. This strategy has been reported to motivate students to learn from the code rather than just hand it in, turning what would be cheating into an assisted learning activity. Clearly, more studies are needed to validate such methods, but it invites us to reimagine teaching strategies. In Latin America, similar pilots could be carried out to see if, for example, allowing AI in an exam but requiring a subsequent oral defense improves or worsens understanding of the subject (Chen et al., 2024; Cotton et al., 2023).

Regional regulatory framework and collaboration: At the macro level, it is worth discussing whether a regional framework or supranational guidelines on academic integrity and AI from leading organizations would be appropriate. This would support countries where the issue is not yet on the agenda, raising awareness and standardizing good practices. Collaboration between countries (sharing case studies, statistics, locally developed tools) is invaluable.

The holding of regional conferences (such as the one in Monterrey) and the increased Latin American presence in international forums such as ICAI, ENAI, and others is a practice that should be continued and expanded, since cheating at one university affects the reputation of the entire education system and social trust in degrees, so addressing them is in the collective interest. From this perspective, universities could stop competing in this area and instead cooperate, for example, by creating common repositories of work to detect inter-university plagiarism, or by agreeing on similar standards for the ethical use of AI.

In short, the discussion reveals that we are at a turning point. On the one hand, academic integrity faces an unprecedented technological challenge that exposes cracks in our practices and values; but on the other hand, that same challenge can catalyze innovations in the way we teach, evaluate, and relate to each other in academia. Theory and practice must now feed back strongly into each other: ethical and pedagogical theory to guide the responsible use of technology, and institutional practice to test and refine these guidelines in the field.

The Latin American landscape, with its advances and setbacks, provides valuable lessons: the importance of institutional will, the centrality of ethical training, the weight of clear regulations, and, across the board, the need to integrate all actors (authorities, teachers, students, technologists) in the construction of solutions. *"Academic integrity in AI"* could be an appropriate name for this new paradigm that is emerging, one that combines the enduring values of honesty with the digital skills of the 21st century.

Conclusions

Higher education in Latin America is at a critical juncture where traditional challenges of academic integrity converge with disruptive challenges imposed by artificial intelligence. While AI has intensified concerns about plagiarism and fraud, it has also served as a catalyst for rethinking and improving academic practices. The key findings can be summarized in three dimensions: understanding, adaptation, and innovation.

In terms of understanding, we have found that academic dishonesty in the region is due to multifactorial causes (cultural, educational, institutional) and that the arrival of tools such as ChatGPT does not create a lack of integrity, but rather amplifies existing gaps in ethical training and assessment design. Studies in Latin America confirm high rates of dishonest behavior among students, but also reveal a growing awareness of its seriousness and a desire for clearer and fairer frameworks (Araya et al., 2023; Contreras-Pacheco et al., 2023; Morales Montes & Lujano Vilchis, 2021). AI, for its part, has been rapidly incorporated into student work, with significant percentages of students using it for academic tasks, raising questions about the authorship and authenticity of intellectual work. However, the picture is not uniform: in some contexts, there has been no dramatic increase in cheating following the emergence of AI, while in others, worrying patterns have been detected. This suggests that the influence of AI varies depending on the type of academic activity and the environment, inviting more nuanced analysis (Chen et al., 2024; Cotton et al., 2023; UNESCO IESALC, 2023).

In terms of adaptation, higher education institutions in Chile, Colombia, and Mexico have begun to adjust their policies and practices. Chile provides an encouraging example with the consolidation of an institutional integrity policy and a formative approach that has permeated its university culture. Colombia contributes profound reflection, linking academic ethics with citizenship and testing innovative pedagogical interventions (e.g., connecting academic cheating with social corruption to change perceptions). . Mexico demonstrates the value of clear regulations and concerted action, leading regional efforts and adopting early measures in response to AI (such as updating regulations and guidelines for teachers). These cases show that, with will and resources, it is possible to respond proactively: by creating committees, training teachers, communicating expectations to students, and collaborating across institutions. However, common challenges are also observed: the need for greater support for teachers in the implementation of policies, variability in the application of sanctions, and the risk of falling behind in the face of rapid technological evolution (Araya et al., 2023; Contreras-Pacheco et al., 2023; Morales Montes & Lujano Vilchis, 2021; UC Chile, 2023).

Finally, we can point out that the crisis posed by AI can translate into substantial improvements in the education system. AI forces us to rethink what and how we assess, driving a transition toward more authentic assessments and more meaningful learning. It also opens the door to leveraging technology itself to ensure integrity: from automatically generating different versions of tests to intelligent monitoring systems and personalized feedback that prevent the need to cheat. The proposed recommendations (from updating policies to redesigning learning experiences) are not cosmetic changes, but transformations that could raise the quality of

education, making students not only unwilling to cheat, but also unable to do so because they find value and support in the educational process. Regional collaboration and the exchange of best practices and research are emerging as crucial factors in accelerating these innovations and preventing each institution from having to "reinvent the wheel" separately.

In conclusion, academic integrity and artificial intelligence do not have to be opposing forces. With leadership, creativity, and ethical commitment, Latin American universities can integrate AI responsibly. As educators, it is our responsibility to ensure that honesty prevails beyond any technological advances.

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Pedagogical innovation in interventional radiology: application of the Spatial i.o metaverse for cooperative learning

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Introduction

Health sciences education is undergoing a profound transformation driven by technological advances and new generations of students with high digital literacy (Kandamaran et al., 2022). Today's learning environments demand active methodologies that promote student participation, collaboration, and autonomy. In this context, cooperative learning theory holds that knowledge is constructed more effectively when working in teams than individually, as peer interaction encourages communication, shared reflection, and joint problem solving (Pan et al., 2023). Its implementation in higher education has been shown to improve attitude, academic and clinical performance, and increase student satisfaction (Lee et al., 2025).

At the same time, the incorporation of virtual reality (VR) and other immersive technologies into university education has opened up new possibilities for facilitating cooperative learning (Wang et al., 2023). The COVID-19 pandemic accelerated the adoption of digital environments, transforming traditional face-to-face classes into virtual experiences that required adaptability and creativity from teachers and students (Peters et al., 2023). Despite initial difficulties—such as limited communication, technological anxiety, or lack of experience—this change prompted the exploration of new interactive tools that transcended two-dimensional videoconferencing, giving way to innovations such as augmented, mixed, and virtual reality (De Gagne et al., 2023).

In the field of interventional radiology, practical teaching and simulation are essential for developing clinical and communication skills. Immersive environments allow real-world contexts to be recreated where students can practice procedures, interact with equipment, and make clinical decisions in real time without compromising patient safety (Fowler et al., 2023). These collaborative experiences foster interdisciplinary work and professional communication, essential skills in complex hospital settings (Peter et al., 2024).

Likewise, teaching methods based on games, simulators, and mobile applications have been shown to increase motivation, participation, and knowledge retention (Banerjee et al., 2023). In

this scenario, the metaverse emerges as an interactive three-dimensional environment that enables cooperative learning through avatars, social interaction, and shared activities. Platforms such as Spatial allow for the design of customized educational scenarios, simulating clinical rooms or laboratories, and promoting collaboration between students from different disciplines (Spatial, 2024).

In this way, the convergence between cooperative learning and the metaverse offers an innovative educational model capable of integrating clinical practice, social interaction, and technological immersion. This proposal redefines the teaching of interventional radiology by transferring the educational experience to a collaborative, flexible digital space adapted to the needs of new generations of healthcare professionals.

Cooperative learning (CL) has been widely studied as a student-centered pedagogical strategy that promotes active participation and teamwork. Johnson et al. (1999) and Fathman & Kessler (1993) established its foundations, highlighting positive interdependence, interaction, social skills, group reflection, heterogeneity, evaluation, and mentoring as essential dimensions for its effective application. This methodology not only improves academic performance but also strengthens communication skills, shared responsibility, and conflict resolution (Cruz et al., 2022; Gómez et al., 2023).

In the health sciences, where multidisciplinary work is essential, CL takes on special relevance. Several studies show that cooperation between students from different disciplines improves understanding of professional roles, the quality of clinical work, and patient safety (Fowler et al., 2023). In addition, it fosters social and leadership skills that are difficult to acquire in competitive or individualistic environments (Flores and Hernández, 2020).

However, its effective implementation requires trained mediators to guide group dynamics and ensure fair evaluation. Woods and Chen (2010) point out the importance of using rubrics, self-assessments, and peer assessments to promote individual and collective reflection. Nevertheless, limitations such as teacher resistance, lack of time, and the difficulty of designing authentic cooperative activities in virtual environments still persist (Gonzales et al., 2015).

In recent years, immersive technologies have revitalized cooperative learning strategies. Virtual reality (VR), augmented reality (AR), and mixed reality (MR) facilitate the creation of simulated scenarios where students can interact, practice clinical skills, and solve cases as a team (De Gagne et al., 2023). These tools are especially valuable in practical subjects such as interventional radiology, where clinical risks and equipment costs limit in-person practice (Aguado and Sendra, 2023).

Recent literature highlights the metaverse as an advanced extension of virtual reality that allows three-dimensional interaction through avatars. Initially conceived by Stephenson (1992) in *Snow Crash* and taken up by contemporary platforms such as *Spatial*, the metaverse is establishing itself as a shared, persistent, and decentralized environment (Chen et al., 2023). Its educational potential lies in the possibility of recreating interactive virtual classrooms, fostering collaboration, and reducing geographical and logistical barriers (Zakarneh et al., 2024).

The rise of the metaverse in educational research is recent but exponential: while between 2019 and 2021 there were few academic references, from 2022 onwards there was a significant increase in publications, especially in Asia and North America (Gómez et al., 2024). In Latin America, its implementation remains limited by technological costs and language barriers, although progress is being made in medical education (Pakrash et al., 2023).

In the field of interventional radiology, the metaverse can replicate complex clinical procedures and promote cooperative learning among students through clinical simulations, case discussions, and shared decision-making. In addition, avatars allow for personalization of the experience, strengthening user identity and interaction (Kyrlitsias & Grigoriou, 2021). Recent research shows that the use of playful and immersive environments improves attention, knowledge retention, and student motivation (Vest et al., 2020; Mobley et al., 2023).

The Spatial platform is a notable example due to its accessibility and flexibility. It allows for the creation of collaborative rooms, the integration of three-dimensional models, and synchronous interaction between students through personalized avatars (Britton, 2023). In addition, its technical features, such as compatibility with virtual reality devices and web access, facilitate the inclusion of diverse participants without requiring specialized equipment (Spatial, 2024). This makes it a viable tool for universities with limited resources seeking to innovate in medical education.

In summary, the literature shows that cooperative learning, enhanced by the metaverse, represents a paradigm shift in health education. However, its adoption faces challenges: teacher training, technological infrastructure, evaluation of results, and cultural adaptation. Research is needed to empirically analyze the impacts of the metaverse on the acquisition of clinical and socio-emotional skills, especially in Latin American contexts. The integration of platforms such as Spatial may mark the beginning of a new era in medical education, where collaboration, immersion, and technology converge to transform the training of future health professionals.

Therefore, the objective of this research is to evaluate the effect of using the Spatial i.o metaverse as a cooperative learning environment for university students of interventional radiology.

The study sample consisted of 36 fifth-year medical technology students enrolled in the Interventional Radiology course at a public university in Lima, Peru. The average age was 22.08 years (SD = 3.597), with a range between 18 and 34 years. In terms of gender, 50% (n=18) were male and 50% (n=18) were female. All participants had access to electronic devices (laptop or mobile phone) and a stable internet connection, which ensured the proper use of the *Spatial i.o* metaverse during the educational sessions.

In relation to the initial descriptive statistics, the pre-test results showed that the cooperative learning scores were similar in both groups (control and experimental). However, after the implementation of the educational program in the metaverse, a considerable increase was observed in the experimental group, reflecting the positive impact of the immersive experience on the development of cooperative learning.

Overall level of cooperative learning

In the pre-test evaluation, the control group scored 88.9% at the high level and 11.1% at the medium level. The experimental group, on the other hand, scored 94.4% at the high level, 5.6% at the medium level, and 5% at the low level. After the educational intervention, the post-test showed a substantial improvement in the experimental group, reaching 94.4% at the high level and 5.6% at the medium level, with no low levels. In contrast, the control group decreased its proportion at the high level (56%) and increased at the medium level (44%).

These results reflect that the implementation of the Spatial i.o metaverse contributed to strengthening cooperation, interaction, and collaborative work among students, which translated into a higher level of overall cooperative learning.

Dimensions of cooperative learning

In the pre-test evaluation, the control group scored 88.9% and the experimental group scored 94.4% at the high level. In the post-test, the scores were 77.8% and 83.3%, respectively. The results of the inferential analysis using the Mann-Whitney U test showed a significant h e difference in the post-test ($p=0.022 < 0.05$), which shows that the immersive environment fostered collaboration and mutual dependence among the members of the experimental group.

In the interaction dimension, the control group scored 77.8% and the experimental group scored 72.2% at the high level during the pre-test. After the intervention, the values rose to 83.3% in the experimental group and fell to 55.6% in the control group. Inferential analysis showed a significant difference in the post-test ($p=0.006 < 0.05$), indicating that the metaverse allowed for greater communicative exchange and active participation in group activities.

Before the intervention, the high-level percentages were 94.4% for the control group and 83.3% for the experimental group. After the educational program, the experimental group reached 100% at the high level, while the control group decreased to 61.1%. The statistical significance value was $p=0.000$, showing a significant change. This suggests that the immersive experience in the metaverse strengthened interpersonal skills, empathy, and assertive communication in students.

In this dimension, both groups started with high performance levels (88.9% and 94.4%, respectively). In the post-test, the values remained relatively stable, with 83.3% in the control group and 88.9% in the experimental group. The inferential analysis yielded a p-value of 0.279, indicating that there were no statistically significant differences between the two groups. This stability may be due to the fact that the composition of the groups (mix of gender, performance, and skills) remained constant throughout the sessions, limiting the expected variations.

The results showed that, in the pre-test, the control and experimental groups had high levels of 61.1% and 66.7%, respectively. In the post-test, the experimental group significantly increased its high level to 88.9%, while the control group decreased to 44.4%. The inferential analysis yielded a $p=0.002$, confirming a significant difference. This finding suggests that the virtual environment allowed for greater exchange of ideas, self-assessment, and collective feedback.

In the evaluation dimension, the groups showed a high level in the pre-test of 77.8% (control) and 88.9% (experimental). In the post-test, the experimental group maintained a higher performance (83.3%) than the control group (50%). The p-value of 0.020 indicates a significant difference, showing that the use of the metaverse promoted more participatory and reflective self-assessment.

In the tutoring dimension, the pre-test results were similar between both groups (88.9% and 77.8% at a high level). However, in the post-test, the experimental group reached 88.9% at a high level, while the control group decreased to 44.4%. The inferential analysis showed $p=0.000$, reflecting that teacher mediation within the metaverse favored personalized guidance, continuous orientation, and student autonomy.

General comparative analysis

The overall analysis using the Mann-Whitney U test showed that, in the pre-test, the means were 18.44 (control) and 18.56 (experimental), with no significant differences ($p=0.988 > 0.05$). After the educational program was implemented, the means changed to 12.56 (control) and 24.44

(experimental), with a p-value of 0.000 < 0.05, demonstrating a statistically significant increase in the experimental group.

These results confirm the general hypothesis, establishing that the implementation of an educational metaverse based on Interventional Radiology significantly improves cooperative learning in Medical Technology students.

Table 1. *Summary of inferential results*

No.	Dimension	p value Pre-test	p value Post test	Significance
1	Positive interdependence	0.888	0.022	Significant
2	Interaction	0.888	0.006	Significant
3	Social skills	0.606	0.000	Significant
4	Heterogeneity	0.791	0.279	Not significant
5	Group reflection	0.805	0.002	Significant
6	Evaluation	0.443	0.020	Significant
7	Tutoring	0.888	0.000	Significant

Source: Own elaboration.
Note: p>0.05 = not significant; p<0.05 = significant.

General interpretation of the findings

The results show that the Spatial i.o metaverse is an innovative tool that enhances cooperative learning dynamics in higher education settings, especially in technical and practical subjects such as interventional radiology.

The increase in levels in the dimensions of positive interdependence, interaction, social skills, group reflection, evaluation, and mentoring demonstrates that immersive environments promote student engagement, assertive communication, and a sense of shared responsibility in achieving common goals. The only dimension without a significant difference, heterogeneity, suggests that group diversity alone does not guarantee an increase in cooperative learning, but rather requires more intentional pedagogical management on the part of the teacher.

Likewise, statistical values reflect that interactive three-dimensional spaces, such as Spatial portals, promoted active learning, with greater participation, reflection, and cohesion among students. Real-time feedback and the figure of the teacher as a virtual mediator strengthened the sense of community and improved the quality of teamwork.

Overall, the results support the idea that the integration of the educational metaverse not only optimizes cooperative learning but also contributes to the development of digital and socio-emotional skills necessary for contemporary professional practice in health sciences.

The results of this research show that the design of an educational metaverse based on interventional radiology had a positive and significant impact on students' cooperative learning, reaching a bilateral significance level of p=0.000. This finding supports the general hypothesis and demonstrates the effectiveness of using the *Spatial i.o* metaverse as a three-dimensional virtual environment to promote cooperation, communication, and peer interaction in higher education settings.

Coinciding with the findings reported by Wang et al. (2023), who developed 18 virtual educational sessions and found a significant improvement in student participation and collaboration (p=0.015), in this study, 15 sessions were conducted in *Spatial i.o.*, and high motivation and willingness were also observed among the students in the experimental group. Likewise, research such as that of Rudholpi et al. (2024) and Mystakidis (2022) highlight the ability of educational metaverses—such as *Second Life* or *Spatial i.*o.—to eliminate geographical

barriers and create immersive experiences that foster social interaction and academic cooperation, aspects reflected in the improvement of the dimensions *of interaction* and *positive interdependence* (p=0.006 and p=0.022, respectively).

Similarly, Hu et al. (2023) and Singh and Tinmaz (2024) showed that digital collaboration platforms improve reflection, motivation, and ethical decision-making, which is consistent with the results of the present study, where the dimensions *of group reflection* (p=0.002) and *social skills* (p=0.000) showed statistically significant changes. This suggests that working in 3D environments facilitates the development of soft skills essential for professional practice in health sciences. Regarding *teacher mentoring*, the findings are consistent with those of Sia et al. (2021), who highlighted the importance of pedagogical support in collaborative teaching. In this study, the *mentoring* dimension reached a value of p=0.000, demonstrating that the role of the teacher as a virtual mediator was fundamental in guiding and resolving students' doubts in real time.

On the other hand, the *heterogeneity* dimension did not show statistical significance (p=0.279). This result may be related to the difficulty some students have in adapting to working with peers of different academic levels or abilities, which coincides with the observations of Mora (2020), who indicates that heterogeneous groups require more active teacher mediation to generate productive cognitive conflict.

Research by Peña and Rodríguez (2023), García (2023), and Quintana (2022) also corroborates that the use of virtual environments and open educational resources increases the dimensions of cooperative learning, a finding that is replicated in this study with significance in *positive interdependence*, *interaction*, *social skills*, and *group reflection*. According to Álvarez (2022) and Flores (2020), the consolidation of these competencies favors not only academic performance but also professional development in collaborative clinical contexts. Among the limitations of the study are the small sample size, as it involved a single academic group, and technical difficulties related to the connectivity of some students. Despite this, the validity of the results and the active participation of all members during the sessions were maintained. For future studies, it is recommended to expand the population and explore other areas of health sciences with similar immersive methodologies.

Conclusions

Interventional radiology requires professionals capable of working in multidisciplinary teams, combining technical skills with strong social skills. The educational metaverse is an innovative strategy that strengthens cooperative learning, encourages communication, shared responsibility, and collaborative work in virtual environments.

Teacher support within these spaces is essential to ensure meaningful learning and formative assessment. In conclusion, the use of the Spatial i.o metaverse not only enhances cooperative learning in higher education, but also represents a step towards the digital transformation of the training process in health sciences, promoting more participatory and inclusive teaching that is adapted to contemporary technological challenges.

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Effects of microplastics in tea bags and herbal infusions on human health

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Introduction

Microplastics (MP; <5 mm) and nanoplastics (NP; <1 µm) are emerging anthropogenic contaminants found in air, water, and food. Their bioaccumulation and persistence pose an environmental and health challenge. Among food sources, tea and herbal infusions have gained relevance because commercial bags contain synthetic polymers—such as nylon, PET, and PP—used to improve resistance and heat sealing. (Mariano & Dini, 2021)

The material is predominantly found in bottles, bags, and containers where it degrades in the sun. The effects of contaminants affect metabolism in consumption, and the waste they generate affects nature and the ecosystem. (Perilla, 2023)

Contact with hot water (85–100 °C) causes thermal fragmentation, hydrolysis, and migration of additives, leading to the release of plastic particles and monomers. From a chemical point of view, the ester and amide bonds in these polymers are thermodynamically unstable in aqueous media, which explains the observed release.

The study analyzes previous work that addressed the presence of microplastics in tea bags and infusions, which cause microplastic residues to be transferred to the consumer's drink when the leaves are transferred. For the review, they considered those who carried out experimental and observational designs.

The biological effects of MP/NP include the generation of reactive oxygen species (ROS), disruption of cell membranes, modification of the intestinal microbiota, and tissue accumulation. However, human evidence is scarce, and the mechanisms of intestinal absorption, biodistribution, and elimination are still being investigated.

This review seeks to systematically integrate and evaluate the available scientific literature to identify the release patterns, chemical characterization, and toxicological effects of microplastics released from tea bags and herbal infusions, with a view to establishing implications for public health and food safety.

Study selection and characteristics

The search identified multiple records in bibliographic databases and gray literature. After removing duplicates and applying eligibility criteria, a set of analytical studies on MP/NP release in tea and herbal teas was included, along with a subset of relevant toxicological studies.

Eighty-one articles (2016–2024) were reviewed, of which 32 came from Scopus and 59 from ScienceDirect. Most were experimental studies with black tea, green tea, and herbal teas. Nylon and PET bags showed the highest particle release (10^6–10^9 MP/cup and up to 10^{12} NP/cup).

Table 4 *Description and results of the studies included in the review*

AUTHOR	OBJECTIVES	DESIGN	PARTICIPANTS	INSTRUMENT	MAIN RESULTS
Mondal et al. (India)	To determine the abundance of microplastics (MPs) in CTC tea at each stage of processing	Sampling at each stage of the process (harvesting→drying→ grading) and polymer analysis; risk assessment (EDI, HQ, ILCR).	CTC tea samples at key stages; brewed tea.	Polymer identification (e.g., FTIR/Raman reported in the article); counting (10–82 µm).	Abundance 0.4–1.1 particles/g, max. in fermentation; prevalent polymers PE, acrylates, PVC, and nylon; ARMI 6.19–73.9 µg/person/year; HQ and ILCR within safety limits.
Vineet & Pradeed (India)	This study critically examines the presence and release of microplastics from paper cups and tea bags, which are often overlooked, especially in the context of increasing tea consumption in India	Review article (narrative/critical) with a synthesis of recent evidence and research gaps.	Results from previous studies on cups/cups and tea bags are analyzed.	AFM; ATR-FTIR; micro-FTIR; Raman; FPA-Reflectance Micro-FT-IR; Py-GC–MS; LC–MS/MS.	Plastic coatings on paper cups release MPs/NPLs and compounds (e.g., phthalates, BPA, chlorides, nitrates, metals) upon contact with hot beverages; tea bags (NY, PET, PP, PLA) release MPs/NPLs and phthalates; temperature and agitation increase release; pre-washing reduces particles; Reusable alternatives, regulation, and analytical standardization are recommended.
Neamatollah (Iran)	This review critically examines publications related to NPs in tea, focusing on the type of sample, the methods and techniques used to isolate and identify NPs, and the main qualitative and quantitative findings.				
Gooya et al	Trace and quantify microplastics (MPs) from cultivation to processing and tea infusion; estimate dietary exposure.	Laboratory experimental study: simulation of tea preparation, extraction, and characterization of MNPLs; in vitro exposure (24 h, 100 µg/mL) to intestinal cell lines; confocal microscopy and co-localization analysis; statistics with ANOVA and post-hoc tests.	300 bags per type (NY6, PP, cellulose); particle slurries; human colon-derived cell lines (Caco-2, HT29, HT29-MTX). No human participants.	SEM, TEM, ATR-FTIR, DLS, LDV (z-potential), NTA; confocal microscopy; ImageJ/JACoP software and	Confirmed composition: NY6, PP, and cellulose. Sizes (NTA, z-average): ~138.4 nm (NY6), ~136.7 nm (PP), ~244.7 nm (cellulose). NPL count (NTA): 8.18×10^{6}/mL (NY6), 1.20×10^{9}/mL (PP), 1.35×10^{8}/mL (cellulose). Differential internalization: higher in HT29-MTX overall; NY6 with higher internalization in Caco-2; evidence of interaction with the nucleus (3D images).
Xiong et al (China)	Trace and quantify microplastics (MPs) from cultivation to processing and tea infusion; estimate dietary exposure.	Observational-analytical study of traceability throughout the stages of the process (soil, processing, infusion).	Plantation soil and tea samples at different stages of processing; infusions.	SEM/EM for morphology; counting and quantification of MPs; estimation of EDI.	70–3472 pieces/kg; highest abundance in rolled tea (2266 ± 1206 pieces/kg). Very low EDI in loose tea; higher in tea bags reported in literature.
Guzel & Gookaya (Turkey)	Characterize MPs released by 15 tea brands in Türkiye (cup and teapot bags) and assess	Laboratory cross-section with ATF/FTIR in multiple infusion configurations and dry material.	15 brands (A–O); teas in bags (cup and teapot) and dry leaves	ATF/FTIR for identification; counting and classification .	MPs in all brands; predominance of fibers, navy blue color; PET most abundant; sizes 33.65–1680 µm; higher daily exposure in

	risk (MPLI, MPCF, PRI).		extracted from bags.		male smokers; average polymeric risk ~10.8 (low).
Tabakoglu (Turkey)	Quantify MPs and endocrine-disrupting chemicals released from disposable cups and tea bags at different temperatures.	Laboratory tests (50–90 °C) with SEM and LC-MS/MS; confirmation by FTIR.	Paper/plastic cups and tea bags in contact with hot water.	SEM; LC-MS/MS; FTIR.	Tea bags released up to 4.59×10^4 parts/cm³; paper cups 2.94×10^4 and plastic cups 2.11×10^4 parts/cm³. Total phthalates 1.74–2.42 µg/L (bags), 1.49–2.40 µg/L (paper), 1.20–1.28 µg/L (plastic); BPA 0.006–0.045 µg/L.
Sedat (Iran)	To determine the abundance, characteristics (morphology, size, color, and polymer type), and levels of phthalates (PAEs) released from Persian and German tea bags, as well as to estimate the estimated daily intake (EDI) and risks to human health	Experimental laboratory study with physical-chemical analysis of microplastics (MPs) and phthalates in 45 tea bag samples (10 Persian and 5 German brands). Includes quantification, characterization by microscopy and spectroscopy, and risk assessment (HQ and CR)	45 samples of tea bags (30 Persian, 15 German), divided into brands A1–A10 and B1–B5. No human participation. MPs and PAEs particles were analyzed in infusions prepared at 95 °C	Binocular microscope (400×, A. KRÜSS optronic), micro-Raman (LabRam HR Horiba, 785 nm), GC-MS (Agilent Technologies), IBM SPSS 20 and Excel 2016 software for statistical analysis	MPs were detected in all samples (73.6–1446.8 items/Persian bag; 55.6–323.2 items/German bag). Fibers predominated (99.99%), transparent color (99%), size 100–250 µm. Main polymers: PE (53.9%), nylon (42.3%). Total PAEs: 1.48–5.49 mg/g (Persia) and 1.32–3.73 mg/g (Germany), with DEHP and DiBP dominant. Higher EDI in children; HQ and CR > 1 for DEHP and DOP in several brands; it is concluded that tea bags represent a relevant source of exposure to MPs and PAEs
Xu (Ireland)	Develop and apply hyperspectral imaging NIR, and FTIR with multivariate analysis to detect, characterize, and quantify plastics in commercial tea bags; classify brands by material (nylon, cellulose+PP, "biodegradable") and evaluate particle release during infusion (including microwave); highlight the need for rigorous spectral analysis.	nd chemical imaging laboratory study with three modalities: hyperspectral NIR (951–2496 nm), ATR-FTIR (4000–675 cm^{-1}), and microscopic Vis-NIR (400–1000 nm); PCA, unmixing (ASTR) and target detection for abundance maps; infusion and microwave tests.	6 brands (Barry's, Bewley's, Robert Roberts, Twinings, Lyons, Niks) purchased from a supermarket in Ireland; analysis of emptied bags (without leaves) and infusions after infusion; negative controls; n=3 replicates per brand/condition.	NEO HySpex hyperspectral camera with halogen lamps; Thermo Nicolet iN10 microscope with ATR Ge tip; Olympus BX51 microscope with ImSpector V10E spectrograph; MATLAB (PCA, ASTR, processing) and FTIR libraries for matching.	Classification into 3 classes: (1) Nylon 6/6 (Niks); (2) Cellulose+PP composite (Barry's, Bewley's, Robert Roberts, Twinings) with PP approx. 8–29% (NIR) and 6–12% (FTIR) of the pixel area; (3) Mostly cellulose (Lyons, "biodegradable"). In leachates, nylon released numerous plastic particles, increased by microwaves; chemical changes compatible with nylon thermo-oxidation were observed. For cellulose+PP bags, no PP was detected in leachates due to the FTIR detection limit (does not imply actual absence). Particulate load estimates suggest up to ~1.3×10^9 microplastics/bag under their protocol (lower than previous reports due to methodological differences); calculating the plastic/non-plastic ratio and standardizing identification criteria is highlighted.
Hernandez et al (Canada)	Determine whether plastic tea bags release	Laboratory experiment (quantitative): controlled infusion of	Four commercial brands of plastic tea bags (A–D)	SEM (FEI Inspect F50); FTIR-ATR (PerkinElmer	A single plastic sachet releases ≈ 2.3 million micro-particles (>1 µm) and 14.7

	microplastics and nanoplastics during a typical infusion (95 °C) and characterize the composition and number of released particles; explore initial biological effects.	empty plastic bags; morphological/chemical characterization of particles; estimation of loads per cup; acute bioassays with Daphnia magna.	purchased in Montreal, Canada. Empty bags (without leaves) to isolate the contribution of the bag material. No human participants were involved.	Spectrum TWO); XPS (Thermo mono Al K**α**); NTA (NanoSight LM14, 532 nm laser); ICP-MS (PerkinElmer NexION 300) for metaloid ; optical microscopy and CT for D. magna.	billion submicron particles, of which ≈ 3.1 billion are nano (<100 nm) per cup; estimated total mass ≈ 16 µg of plastic per cup. Particle composition matches the envelope material: nylon-6,6 (A–B) and PET (C–D) (FTIR/XPS). Release drops ~300× at room temperature. Leachates (dialysed) alter swimming and cause morphological abnormalities in D. magna; non-dialysed leachates increase immobility (possible contribution of metalloids). Controls rule out contribution from leaves, water, or system.
Dzień et al. (Poland)	To evaluate how water type (pH and mineralization) influences the content of macro- and microelements (Al, B, Ba, Ca, Cu, Fe, K, Mg, Mn, Na, Ni, Sr, Zn) in tea and herbal infusions, and to estimate the health risk from regular consumption (adults and children).	Experimental laboratory study with chemical analysis and non-carcinogenic risk assessment (HQ, HI) according to USEPA in 220 infusions prepared with 5 types of water; comparison with and without tea bags	28 products: black and green tea (Camellia sinensis) and 4 herbs (chamomile, mint, lemon balm, and nettle) from different brands; 16 in bags and 8 in bulk; waters: tap, filtered, filtered with Mg, mineral, and deionized	ICP-OES (Perkin Elmer Optima 7300DV) for element quantification; pH and conductivity measurement; microwave-assisted acid digestion; quality control in accordance with ISO/IEC 17025 and EURACHEM	Black/green tea showed higher Al, Mn, Ni than herbs; e.g., black tea infused with deionized water: Al ~381 mg/kg (averages per matrix/water in Table 4). HI: adults 0.02–0.25, children 0.04–0.98 (not exceeding 1); higher contributions from Mn, Al, Ni; higher HI in black/green teas; mineral water tended to lower HI; using a bag increased HI compared to preparing without a bag

The selected studies come from Europe, Asia, and North America and present diverse academic contributions. In terms of the methodology used, in accordance with the objectives of each study, nine experimental designs and two observational studies were identified.

Ninety-one percent of the articles published cover the period from 2020 to the present, with Turkey and India being the predominant countries.

In the selected experimental designs, the number of tea bags evaluated ranged from 4 to 30 during the intervention. The studies analyzed predominantly focused exclusively on tea bags, while one of them evaluated both paper cups and tea bags.

The main findings of microplastics found include: fibers, a variety of polymers.

The fibers found ranged from nylon and PE to even nanoplastics.

The health risk indices are low, reaching 10.8, as detailed in the study by Mondal et al. (India).

The review indicates that certain plastic materials in tea bags may contribute significantly to the burden of ingested MP/NP. However, translating this into health risk requires linking realistic exposure, bioavailability, and mechanisms of effect in humans. Key uncertainties include: (i) variability in analytical methods and contamination controls; (ii) scarcity of clinical studies; (iii) influences of additives and co-contaminants; (iv) interaction with the food matrix and microbiota.

The systematic review consistently demonstrates that tea bags made from synthetic polymers—especially nylon, polyethylene terephthalate (PET), and polypropylene (PP)—release significant amounts of micro- and nanoplastics (MP/NP) during infusion in hot water. These results, observed in both Scopus and ScienceDirect studies, confirm the ability of heat and exposure time to induce the breakdown of amide and ester bonds, a process characteristic of the thermal and oxidative degradation of polymers. The finding of particles in the range of 50 nm to 100 µm, together with the detection of migrating additives such as phthalates, triethyl citrate, and terephthalate oligomers, reinforces the hypothesis that regular consumption of infusions in plastic bags constitutes a real source of oral exposure to MP/NP.

The studies analyzed show substantial heterogeneity in their experimental designs, which limits the possibility of performing a statistically robust meta-analysis. Differences in infusion temperature (80–100 °C), contact duration (2–10 min), type of water, and analytical techniques (µ-FTIR, Raman, pyrolysis-GC/MS, ICP-OES) influence the final quantification of particles. In particular, the lack of standardized contamination control protocols (QA/QC) and uniform detection limits (LOD/LOQ) generates significant biases in the estimation of actual concentrations. However, despite the variability, all studies agree on the same directional pattern: plastic bags release more particles than paper or plant fiber alternatives, which gives biological consistency and convergence of evidence to the results.

A novel contribution of this review is the integration of experimental studies on herbal infusions that demonstrated the concomitant release of trace metals (Al, Mn, Ni) into the liquid medium, particularly in waters with low pH or high mineralization. This finding is relevant because the surfaces of microplastics can absorb metal ions and act as chemical transport vectors, generating synergistic effects that increase the overall toxicity of the system. From a chemical point of view, this interaction occurs through electrostatic bonds and hydrogen bonds between the functional groups of degraded polymers and dissolved metal cations. Thus, MP not only function as physical pollutants, but also as reactive platforms capable of amplifying exposure to toxic metals.

The toxicological results included in the review—both in vitro and in vivo—consistently point to the activation of cellular oxidative stress pathways (Nrf2, NF-κB), mitochondrial dysfunction, apoptosis, and altered intestinal permeability. In animal models, hepatic inflammatory processes, intestinal dysbiosis, and tissue accumulation in the liver, kidneys, and spleen were observed. These mechanisms are biologically plausible and explain how chronic exposure to low doses of MP/NP could contribute to systemic or metabolic inflammatory processes in humans. However, direct extrapolation of these results requires caution, as the experimental doses exceed those that a typical tea consumer might receive daily, although they reflect potential long-term cumulative risks.

Despite the growing number of experimental studies, evidence in humans remains fragmentary. Recent research detecting microplastics in blood (Leslie et al., 2022), placenta, and intestinal tissues confirms the possibility of systemic exposure but does not yet establish the relative contribution of tea or herbal teas as a major route. There is a lack of validated biomarkers of exposure and effect, as well as longitudinal clinical trials correlating MP/NP intake with physiological alterations. Furthermore, the oral bioavailability of plastic nanoparticles depends on individual variables such as diet, gastric pH, and gut microbiota. These gaps limit the estimation of population risk and underscore the need for controlled clinical and epidemiological studies.

From a public health perspective, the results of this review support the adoption of the precautionary principle regarding the use of plastics in food contact applications. It is imperative that the industry progressively replace synthetic polymers with biodegradable biopolymers (PLA, PHA, regenerated cellulose) and establish standardized thermal migration tests (ISO 177). Likewise, regulatory bodies should require transparent labeling of food contact materials, promote research into sustainable alternatives, and encourage exposure reduction policies. At the scientific level, there is an urgent need to move toward interdisciplinary integration between analytical chemistry, molecular biology, and materials science to develop predictive models of toxicological risk, supported by reproducible and comparative evidence.

Conclusions

Studies showed that tea bags made of nylon (PA-6), PET, and PP release micro- and nanoplastics under standard infusion conditions (85–100 °C). This phenomenon is explained by molecular mechanisms specific to each polymer: hydrolysis of ester bonds (PET), rupture of amide bonds (nylon), thermal oxidation, and mechanical fatigue induced by the hot aqueous medium. The amounts released—which can reach billions of microplastics and trillions of nanoplastics per cup under thermal stress—are consistent with the intrinsic chemical susceptibility of these materials.

The extent of release depends critically on experimental variables such as temperature, contact time, pH, and ionic strength of the water. Slightly acidic media with higher ionic strength accelerate surface depolymerization, delamination, and rupture of outer layers. This highlights the need for studies to standardize these conditions to allow valid comparisons of release per cup.

In addition to solid particles, co-migration of additives (phthalates, citrates), oligomers, and low molecular weight fragments was observed. In the infusion medium—rich in polyphenols and proteins—the particles develop organic crowns that alter their surface charge, interfacial energy, aggregation, and bioavailability, which can significantly modify their behavior in biological systems.

Several studies reported the release of Al, Mn, and Ni during herbal infusion. These metal species can adsorb to the surface of micro- and nanoplastics, especially in oxidized areas or areas with polar functional groups, creating highly reactive metal-plastic complexes. This reveals synergies between polymer and metal contamination that should not be evaluated in isolation.

Although evidence in humans is still limited, in vitro and in vivo studies are consistent and show oxidative stress, mitochondrial damage, apoptosis, intestinal barrier disruption, liver inflammation, and bioaccumulation. These effects are explained by:

- the surface chemistry of micro-/nanoplastics,
- the presence of migrated additives,
- adsorbed organic crowns,
- and metal-polymer interaction.

The literature agrees that realistic doses based on particles per cup/day are required, as well as tests using real food matrices (teas with tannins and salts) to improve toxicological translatability.

The heterogeneity between studies is mainly due to differences in contamination controls, detection limits, polymer identification, quantification methods, and unit conversion. For a valid meta-analysis, standards should include:

- harmonized units (particles/cup and µg/cup),
- mandatory laboratory blanks,
- confirmatory identification (µ-FTIR/Raman + pyrolysis-GC/MS),
- detailed reporting of size and morphology,
- strict QA/QC protocols.

These conditions are essential for reducing bias, improving replicability, and increasing the robustness of exposure estimates.

Evidence suggests that mitigation should focus on:

- eliminating internal thermoplastic films used to seal bags;
- migrating to regenerated cellulose or biopolymers with high thermal and hydrolytic stability;
- using non-thermal physical anchors and green additives;
- establishing specific thermal migration regulations for hot infusions.

The evidence compiled in this systematic review concludes that tea bags made from synthetic polymers release micro- and nanoplastics, along with additives and metals, in significant quantities under standard brewing conditions. These materials undergo thermo-induced and chemical degradation processes depending on the type of polymer, temperature, and water characteristics, generating particles with high surface reactivity. Although preliminary

toxicological evidence is consistent with these mechanisms, significant gaps remain that limit the assessment of risk in humans. Unified analytical standards, realistic exposure studies, and a transition to safer materials are required to ensure consumer protection.

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Can ChatGPT help us with our research? Evaluating its usefulness in systematic reviews of literature on scientific communication and citizen participation

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This research is linked to the COMCIPA Research Project (Ref. F1270, 2024/SOLCON-137311, IP: Jennifer García Carrizo), funded within the IMPULSO Research Project of the Rey Juan Carlos University for the year 2024 under its own research promotion and development program.

Introduction

The purpose of this chapter is to analyze the role that artificial intelligence can play in systematic literature reviews focused on citizen participation and scientific communication. The research question that guides this work is: Can artificial intelligence improve efficiency in document selection without compromising the quality and methodological rigor of the systematic review process?

To address this question, the chapter is structured into several sections. First, the theoretical and practical background framing the use of artificial intelligence in research processes, particularly in the field of systematic reviews, is presented. Next, the methodological design adopted is described in detail, highlighting the comparison between the traditional manual process and the artificial intelligence-assisted process, using ChatGPT as a support tool in document classification and analysis.

Subsequently, the results obtained are presented, paying special attention to efficiency in terms of time, as well as the quality and comprehensiveness of the document selection. Finally, the main conclusions are presented and the implications of using these technologies in academic research are discussed, as well as their limitations and possibilities for improvement in educational and scientific contexts.

In recent years, the growing volume of scientific production has made systematic literature reviews (SLRs) an essential methodological tool for synthesizing knowledge in a rigorous and up-to-date manner. This type of review is distinguished by its structured, reproducible, and transparent approach, following protocols such as PRISMA (www.prisma-statement.org) that require precise documentation at each stage of the process. Its purpose is not only to compile studies but also to identify patterns, gaps, and trends in a given field of research.

The SLR process is usually divided into several fundamental phases: (1) formulation of the research question, (2) definition of inclusion and exclusion criteria, (3) comprehensive database search, (4) initial screening of articles (by title and abstract), (5) full-text reading of preselected documents, (6) data extraction, (7) methodological quality assessment, (8) synthesis of results, and (9) report or meta-analysis writing, as appropriate for the type of review.

This research focuses specifically on one of the most critical and demanding phases: the initial screening stage or preliminary selection phase, in which researchers must manually review the titles and abstracts of a large volume of articles to identify those that meet the previously defined thematic and methodological criteria. This stage can account for between 40% and 60% of the total time spent on a systematic review, according to previous studies in educational research and bibliometrics (Boell & Cecez-Kecmanovic, 2015; Gough et al., 2017), and is especially complex when the research topic is cross-cutting or interdisciplinary—as is the case in projects on scientific communication and citizen participation.

Added to this is the risk of variability in results due to human bias, interpretative differences, or cognitive fatigue during the classification process. In this context, the incorporation of artificial intelligence tools to support initial document screening presents a promising opportunity. AI can help reduce the time spent on this critical phase by offering an initial classification based on defined criteria and allowing the research team to focus on reading and analyzing articles with greater potential.

However, it is still necessary to assess the extent to which these tools can replicate or complement expert judgment, especially in complex topics that require contextual interpretation. The present research fits into this framework of methodological reflection. Its objective is to compare the results obtained through traditional document screening, carried out manually by an expert team, with AI-assisted classification using the ChatGPT model. The analysis is carried out within the framework of the COMCIPA research project, which focuses on citizen participation and scientific communication, and aims not only to measure the efficiency of the automated approach, but also to assess its accuracy, limitations, and practical usefulness in real academic research processes.

The object of study is the process of systematic review of scientific literature related to citizen participation in scientific and cultural communication. The perspective adopted is methodological, focused on evaluating the efficiency, rigor, and possibilities of integrating artificial intelligence as a support tool in document selection processes.

This is an exploratory and comparative research study with a methodological and applied approach. The strategy adopted allows us to observe differences between manual and automated procedures without attempting statistical generalization, but with an interest in opening up new lines of reflection and analysis.

The universe of work is composed of scientific publications focused on citizen participation in scientific and cultural communication, as this research is carried out within the research project "COMCIPA: Communication, Science, and Citizen Participation - New interactive and immersive models in educational and cultural settings." The unit of analysis is the academic articles identified and evaluated during the review process. The study is cross-sectional, with a time frame of publications between the years selected for the search (2019-2024).

The initial selection of documents was carried out using a structured search in the Scopus database, which identified articles published between 2019 and 2024. To do this, the search operators listed in Table 1 were applied, organized thematically and used throughout the article,

not limited to just the title or keywords. It should be noted that an additional operator was introduced as a "control," which was not related to the COMCIPA research project or the topic of this systematic review (SLR). The inclusion of this operator was intended to verify whether ChatGPT selected any of these articles as relevant to the project. This operator was incorporated by one of the research team members who did not participate in the manual selection or the ChatGPT selection of the most relevant articles. The purpose was to evaluate whether the automated and manual selection were being performed correctly.

The search operators were grouped into ten thematic blocks combining concepts such as citizen participation, gamification, scientific literacy, STEM education, immersive communication, and impact assessment.

Table 1. *Search operators used in Scopus to identify articles of interest to the COMCIPA project. It includes a "control" operator that is not relevant to the project, 10.*

Theme	Search operator
1. General search for citizen participation and scientific communication	("Citizen participation" OR "public engagement" OR "civic engagement") AND ("Science communication" OR "scientific dissemination" OR "scientific outreach") AND ("Interactive communication" OR "immersive communication" OR "digital storytelling")
2. Search on Immersive Techniques in Education and Culture	("Virtual reality" OR "augmented reality" OR "mixed reality" OR "extended reality" OR "XR") AND ("Gamification" OR "game-based learning" OR "serious games" OR "educational games") AND ("Science education" OR "STEM education" OR "scientific literacy" OR "science outreach") AND ("Citizen science" OR "public engagement" OR "participatory science" OR "community involvement") AND ("Immersive learning" OR "interactive learning" OR "experiential learning") AND ("Impact assessment" OR "effectiveness study" OR "learning outcomes")
3. Search on Factors that Encourage Citizen Participation	("Citizen engagement" OR "public participation" OR "community involvement") AND ("Educational communication" OR "cultural communication") AND ("Interactive learning" OR "immersive experiences" OR "experiential learning")
4. Search on Evaluation Methods in Science Communication	("Science communication" OR "scientific outreach" OR "public science education" OR "science literacy") AND ("Impact assessment" OR "effectiveness evaluation" OR "engagement measurement" OR "evaluation framework" OR "public perception") AND ("Citizen science" OR "public engagement" OR "participatory science" OR "community involvement") AND ("STEM education" OR "higher education" OR "informal learning") AND ("Social impact" OR "policy impact" OR "behavioral change")
5. Gamification and Citizen Participation in Science and Culture	("Gamification" OR "game-based learning" OR "serious games" OR "educational games") AND ("Citizen participation" OR "public engagement" OR "civic involvement" OR "community science") AND ("Science communication" OR "scientific dissemination" OR "public science education" OR "science outreach") AND ("education" OR "informal learning" OR "museum education") AND ("culture")
6. Space Simulations in Education and Citizen Science	("Space simulations" OR "virtual environments" OR "immersive simulations") AND ("STEM education" OR "science literacy" OR "public science education") AND ("Citizen engagement" OR "participatory science" OR "crowdsourced science")
7. Gamification and Citizen Science in Space Projects	("Gamification" OR "game mechanics" OR "serious games") AND ("Citizen science" OR "participatory science" OR "public engagement in science") AND ("Space exploration" OR "astronomy education" OR "astrobiology outreach")
8. Immersive Simulations and	("Immersive learning" OR "virtual simulations in education" OR "augmented reality in learning" OR "virtual reality for educational purposes")

Gamification in Science Education	AND ("Gamification in education" OR "game-based learning in STEM" OR "serious games for educational purposes") AND ("Science education" OR "scientific literacy in K-12" OR "STEM education initiatives" OR "scientific communication strategies")
9. Space Games and Simulations for Public Participation	("Space simulations" OR "NASA simulations" OR "Mars colonization") AND ("Public engagement" OR "participation" OR "civic involvement") AND ("communication" OR "scientific outreach" OR "education")
10.a MDRS Simulations and Scientific Communication	("Mars Desert Research Station" OR "MDRS" OR "analog Mars missions" OR "space analog research") AND ("Simulation-based learning" OR "immersive simulation" OR "virtual simulation" OR "serious games")
10.b MDRS Simulations and Scientific Communication	("Mars Desert Research Station" OR "MDRS" OR "analog Mars missions" OR "space analog research") AND ("Citizen science" OR "public engagement" OR "participatory science" OR "science outreach")
10.c MDRS Simulations and Scientific Communication	("Mars Desert Research Station" OR "MDRS" OR "analog Mars missions" OR "space analog research") AND ("Science communication" OR "scientific dissemination" OR "STEM education")
10.d MDRS Simulations and Science Communication	("Mars Desert Research Station" OR "MDRS" OR "analog Mars missions" OR "space analog research") AND ("Gamification" OR "game-based learning" OR "experiential learning")

Based on the corpus obtained, two procedures were applied: one manual, developed by the research team; and another supported by artificial intelligence, using ChatGPT for the initial reading and classification of abstracts and titles.

The process was developed under the PRISMA model[3] , ensuring the traceability and reproducibility of the process and methodological transparency. Shared decision matrices were used to document the inclusion and exclusion criteria in both modalities. In the artificial intelligence-assisted approach, the selected texts were entered into ChatGPT to assess their relevance according to criteria previously defined by the research team. The entire procedure, including the data, was documented and shared in open access through the Zenodo platform (www.doi.org/10.5281/zenodo.15389120).

Fieldwork and Data Analysis

The fieldwork consisted of implementing a systematic literature review (SLR) focused on analyzing research on citizen participation and scientific communication with the support of artificial intelligence tools. Data collection and analysis were carried out between January and April 2025, using the Scopus database as the main source of information.

The search strategy employed a combination of the Boolean operators described above. In addition, the built-in "control" operator is intended to test the sensitivity of the automated document selection process.

Once the corpus of documents relevant to the SLR in question had been identified, two complementary approaches were applied for its analysis: a manual procedure developed by one member of the research team, and another assisted by artificial intelligence, using ChatGPT for

[3] The PRISMA model for SLR (Systematic Literature Review) is a guide that provides guidelines for the publication of systematic reviews, ensuring transparency and rigor in methodology and results.

reading, preliminary classification, and evaluation of abstracts and titles, carried out by another member of the research team.

Shared decision matrices were used to document the inclusion and exclusion criteria in both modalities. The AI was fed with the criteria previously defined by the research team, allowing its performance to be evaluated in relation to the manual process: it was provided with an evaluation table based on a five-level Likert scale (see Table 2), specifically designed to assess the degree of alignment of each publication with the objectives of the COMCIPA project. This rubric contained detailed descriptions and specific criteria for each level.

Table 2: *Rubric for assessing articles based on their degree of relevance to the COMCIPA project, used in both the manual and automated processes.*

Level	Value on Likert scale	Description	Criteria and Characteristics
1	Not relevant	Total absence of connection with COMCIPA	Excessively technical or disciplinary topics. No link to science, education, or communication. Inapplicable to contexts such as museums, schools, or educational spaces. Does not address citizenship, scientific culture, or participation.
2	Low relevance	Minimal connection to the project	Superficial mentions of related topics (technology, participation). Impractical or decontextualized approach. Limited or inapplicable results. Little connection with the public communication framework.
3	Medium relevance	Partial alignment with COMCIPA objectives	Addresses topics such as culture, science, or gamification, but with little development of the communicative or civic dimension. Results useful for the general context, but with no direct impact on project actions. Provides complementary ideas, but not central ones.
4	High relevance	Good alignment with the pillars of the project	Clear link to citizen participation, STEM literacy, science, and communication. Contexts that can be extrapolated to educational or cultural spaces. Applicable results, although with room for further development.
5	Highly relevant	Fully and directly aligned with COMCIPA	Contributes directly to the project from key pillars (participation, scientific culture, gamification, immersion, communication). Highly applicable to museums, educational platforms, cultural spaces. Transferable results with high practical value.

Source: own elaboration.

Based on this rubric, the identified documents were classified automatically and manually, assigning a score to each one according to its suitability for the project's objectives. This process made it possible to compare the evaluation carried out by the AI with the manual selection, analyzing their degree of agreement.

Step 1. Identification and refinement of the document corpus

The bibliographic search in the Scopus database was carried out between February 17 and 27, 2025, using the previously defined search operators and limiting the results to the period 2019-2024. This initial search yielded a total of 363 documents.

After a thorough review, the corpus was refined by applying various exclusion filters:

- 46 records were eliminated because they did not actually fall within the established time interval (2019-2024), despite having been returned by Scopus. This systematic error in the database was detected during the manual validation of the process. In fact, despite applying the time filter, the database returned articles published in 2013 or 2014.
- Seven documents were discarded because they were conference proceedings and did not meet the criterion of being peer-reviewed scientific articles.
- Sixteen results corresponded to duplicate records, present under multiple combinations of Boolean operators.
- Finally, five articles were eliminated because they were not accessible through the academic libraries to which the research team had access, such as the libraries of the Complutense University of Madrid, the Open University of Catalonia, Rey Juan Carlos University, the Distance University of Madrid, and CEU San Pablo University, nor through open searches on the internet or other complementary academic databases.

After this cleaning process, the final corpus consisted of 289 valid scientific articles, all of which were available for complete analysis.

Step 2. Manual and AI-assisted evaluation

Each of the 289 articles was evaluated using two parallel procedures:

1. Manual evaluation, carried out by part of the research team, applying the Likert scale (1 to 5) relevance rubric designed specifically to measure the suitability of each publication for the COMCIPA project objectives.
2. AI-assisted evaluation, in which ChatGPT received the abstracts and titles of the articles along with the evaluation rubric and a summary of the COMCIPA research project. The AI classified each document according to its estimated level of relevance, following the same criteria used by the human team. This AI-assisted evaluation was carried out by another part of the research team that did not participate in the manual evaluation.

Both procedures made it possible to compare the similarities and differences in the classifications obtained, as well as to assess the accuracy of the automated system in relation to expert interpretation. This comparative approach provided valuable information on the efficiency and margins of error of automated analysis applied to systematic review processes in the field of scientific communication and citizen participation.

During both the manual and automatic evaluation processes, articles considered to be of "high" or "very high" relevance (levels 4 and 5 of the rubric) were identified for each study analyzed. This classification is key to the systematic review process, as it delimits the set of documents that would be read in full in the later stages of the SLR proposed in this research.

Of the total of 289 articles analyzed, the part of the research team that was using ChatGPT identified a total of 65 articles as relevant (score 4 or 5). For its part, the research team that was evaluating manually considered 194 articles to be relevant.

A cross-analysis of these data showed that the 65 articles selected by the AI coincided completely with the selection made by the human team, i.e., there were no false positives in the assisted evaluation: all the articles considered relevant by ChatGPT were also considered relevant by the researchers. However, the automated tool left out a significant proportion of documents that the research team considered relevant: 129 articles rated 4 or 5 by the human team were not classified with that score by ChatGPT.

To better understand this divergence, a review of these 129 documents not selected by ChatGPT was conducted. The analysis revealed that all of them had been classified with a score of 3 by the AI, i.e., considered to be of medium relevance. This suggests that the automated system managed to identify a certain degree of thematic affinity with the objectives of the COMCIPA project, but was more conservative in assigning them a score that would allow them to move on to the next phase of analysis in a systematic review.

This pattern indicates that the AI tended to partially underestimate the potential of certain articles, probably due to:

- Vague descriptions in titles or abstracts, which made it difficult to automatically recognize key elements such as citizen participation, gamification, or scientific communication.
- Interdisciplinary or implicit approaches, which required more complex contextual judgment, something that the tool could only partially address with the information provided.

In terms of performance, the automated system showed:

- High precision (all those selected were indeed relevant).
- Moderate sensitivity (it omitted articles that could also have been useful).
- A conservative tendency, focusing on selecting only those documents whose relevance was clearly evident in the analyzed text.

This behavior reinforces the usefulness of AI as an effective initial filter to reduce the volume of reading in the early stages, although its use should be understood as complementary to, rather than a substitute for, expert judgment, especially when seeking broad and contextualized coverage of existing knowledge.

In addition to the comparative analysis between the two evaluation procedures, the effectiveness of both approaches (manual and AI-assisted) was also examined with respect to the articles retrieved using the control search operator (included in thematic block 10). This operator was intentionally introduced into the search strategy to verify whether any of the methodologies identified as relevant articles that, in reality, were not thematically related to the objectives of the COMCIPA project.

The result was conclusive: none of the articles incorporated using this control operator were considered relevant by either ChatGPT or the research team. This coincidence reinforces the

validity of the criteria applied in both modalities and confirms that both the automated and manual processes were able to adequately discriminate documents outside the thematic scope of the study. In other words, the artificial intelligence system was not fooled by the presence of potentially attractive but contextually irrelevant keywords , which reinforces its accuracy as an initial filtering tool.

Time comparison: efficiency of automated analysis

In addition to the qualitative comparison between the manual and AI-assisted processes, an estimate was made of the time spent on each method to evaluate the operational efficiency of the automated approach by each member of the research team.

The analysis with ChatGPT (in its Plus version) was carried out by entering the articles one by one, providing the title, abstract, a summary of the COMCIPA project, and the Likert scale evaluation rubric. This procedure was performed by a member of the research team, applying the same protocol to each of the 289 articles in question.

On average, the time required per article (including copying the text, formulating the request, waiting for the response, and recording the score) was approximately 2.5 minutes. This translates to an estimated total time of 289 articles × 2.5 minutes ≈ 12 hours of continuous work.

This time could be significantly reduced with automation or batch loading, but in this study, individualized interaction was chosen to ensure that each evaluation strictly adhered to the defined rubric. In fact, when batch loading was attempted, ChatGPT systematically made errors, mistaking the information in each article and mixing them up with each other, without giving a valid result.

In the case of the evaluation carried out by the research team, it has been estimated that a basic scan of each article to identify its validity and relevance to the research project took between 6 and 10 minutes on average. This variability is due to the need for critical interpretation, contextual review, and, on occasion, additional consultation of keywords or references within the text. Assuming a conservative average of 8 minutes per article, the total estimated time was 289 articles × 8 minutes ≈ 38.5 hours of effective work.

This time was also distributed among several team members over several days or weeks, given that the cognitive effort required makes it difficult to maintain a constant pace of evaluation without affecting the quality of expert judgment, which, for example, was not the case with artificial intelligence.

In this sense, the AI-assisted procedure proved to be more than three times faster than manual evaluation. However, as seen in the previous analysis, this gain in efficiency was accompanied by a reduction in the sensitivity of the system, which reaffirms the need to interpret these systems as complementary tools, useful for initial screening, but still insufficient as the sole source of decision-making in systematic reviews that require in-depth and contextual analysis.

Conclusions

The results obtained in this research confirm both the potential and the limitations of using artificial intelligence, specifically ChatGPT, in the document screening process for systematic reviews. As previous studies have pointed out (Marshall & Wallace, 2019; O'Connor et al., 2019), automated tools significantly speed up the initial analysis stage, reducing the time required to select articles with the greatest thematic affinity to the subject of study. In our case, AI-assisted

evaluation completed the analysis of 289 articles in approximately 12 hours of effective work, in contrast to the estimated 38.5 hours for manual review by the research team. This difference reinforces the operational usefulness of such systems, especially when dealing with large volumes of scientific literature.

However, the improvement in efficiency was not accompanied by comparable sensitivity. Although all articles classified as relevant by ChatGPT were also classified as such by the human team (showing 100% accuracy), the system left out 129 articles that the researchers considered highly relevant to the COMCIPA project. A subsequent review revealed that all of these documents had received a score of 3 from the model, indicating an assessment of medium relevance that did not meet the threshold (levels 4 or 5) for inclusion in the systematic review. This conservative tendency in assigning scores suggests that ChatGPT is effective at identifying publications clearly aligned with the evaluation criteria, but tends to exclude those whose connection to the project requires a more contextual or cross-cutting interpretation, which is common in interdisciplinary fields such as scientific communication and citizen participation. This behavior is consistent with that observed in studies such as those by Tsafnat et al. (2014) and van de Schoot et al. (2021), which document that automated models perform well in detecting central articles but are less competent when it comes to capturing implicit nuances or indirect relationships between concepts. Therefore, while AI can be an ally in reducing initial effort, it does not replace expert judgment in tasks where thoroughness and contextual criteria are essential.

One particularly relevant aspect was the treatment of articles introduced using the control search operator. None of them were classified as relevant by either method, suggesting that both AI and the human team were able to adequately discriminate documents that, although they contained technical or attractive terms, had no real connection to the project's objectives. This finding reinforces the reliability of the criteria applied in both modalities, while underscoring the model's accuracy in avoiding false positives. In light of these results, it should be noted that ChatGPT may have a legitimate place in the academic research lifecycle, but with a defined scope. Its usefulness seems particularly valuable in preliminary phases, such as preparing a research proposal or conducting a quick review of the state of the art, where the most important thing is to obtain a general overview of the field in a short time. In these cases, AI can facilitate initial exploration, help define thematic lines, and identify key publications without requiring an exhaustive review. However, when it comes to long-term research projects, such as those funded nationally or internationally in calls for proposals lasting approximately four years or doctoral theses, where the literature review must be comprehensive, well-argued, and methodologically sound, the exclusive use of AI is not sufficient. Systematic review in these contexts requires a degree of thoroughness that can currently only be guaranteed by human evaluation, capable of capturing conceptual, theoretical, and contextual dimensions that models do not yet interpret with sufficient accuracy.

Therefore, although the use of ChatGPT in document review processes is a useful tool, it is not self-sufficient. Its use as a rapid screening system can improve the efficiency of the process and reduce the initial workload, but its application must be accompanied by expert supervision to ensure the quality and thoroughness of the results. Far from replacing human judgment, artificial intelligence should be understood as a strategic complement, useful for streamlining operational tasks and guiding preliminary decisions, but not as a substitute for the rigorous academic analysis required in the most demanding research frameworks.

In this way, this research has not only made it possible to contrast two ways of approaching scientific knowledge—expert reading and automated analysis—but also to open up a space for

reflection on how we want to conduct research in the age of artificial intelligence. ChatGPT has proven to be an effective ally in saving time and guiding searches, but it has also revealed its limitations when it comes to capturing nuances, contexts, and connections that only human judgment can fully interpret.

At a time when information overload is a real challenge for any academic team, exploring tools that streamline processes is not only desirable but necessary. However, this study reminds us that speed does not always equate to depth, and that in scientific research—especially that which seeks to understand complex social phenomena—critical thinking, careful analysis, and contextualized interpretation remain indispensable.

As with any technology, the true value of artificial intelligence in research lies not in replacing humans, but in enhancing their capabilities. Using ChatGPT in a systematic review can be useful, especially in exploratory stages or as part of an initial search, but the quality and rigor of knowledge ultimately still depend on our ability to think, compare, and decide. Much of the future of academic research hinges on this balance between automation and expert judgment.

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Portuguese cinema between 2019 and 2024: production, distribution, and exhibition

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Introduction

The ICA is a public institute integrated into the indirect administration of the Portuguese State, endowed with administrative and financial autonomy and its own assets, under the supervision of the Secretary of State for Culture (ICA, 2025c). Its mission is to support the development of film and audiovisual activities in Portugal (ICA, 2025c).

This institute was created by Decree-Law No. 95/2007 of March 29, resulting from the restructuring of the Institute of Cinema, Audiovisual and Multimedia (ICAM), in order to respond to the need to adapt and deepen its actions in the area of intervention (ICA, 2025c).

In the context of the reform of the Public Administration determined by the Plan for the Reduction and Improvement of the Central Administration, the organization of the ICA was modified in accordance with Decree-Law No. 79/2012, of March 27, maintaining its scope of action and responsibility for supporting the development of cinematographic and audiovisual activities (ICA, 2025c).

However, the ICA has its origins in the Portuguese Film Institute (IPC), which was created in 1971 by Law 7/71 of December 7, with the purpose of: encouraging and regulating film activities in their industrial and commercial forms of film production, distribution, and exhibition; represent Portuguese cinema in international organizations; promote the international relations of Portuguese cinema in the cultural, economic, and financial spheres; and foster film culture (ICA, 2025c).

Thus, the ICA's responsibilities include: granting annual financial support through public competition; establishing protocols with various entities in the areas of film and audiovisual media; ensuring national representation in international institutions and bodies in the fields of film and audiovisual media; registering film and audiovisual companies and works (ICA, 2025c).

The following section discusses the production of Portuguese cinematographic works that have received financial support from the ICA between 2019 and 2024, as well as their distribution and exhibition.

Production of Portuguese Cinematographic Works

In 2019, 66 Portuguese films were produced with financial support from the ICA, of which 37 were feature films (22 fiction and 15 documentaries) and 29 were short films (16 fiction, four documentaries, and nine animated films) (ICA, 2020a, 2020b, 2021a, 2021b, 2022a, 2022b, 2023, 2024a, 2024b, 2025a, 2025b).

The following year, 2020, the first year of the COVID-19 pandemic, the ICA provided financial support for the production of 49 national film projects, specifically 25 feature films (11 fiction, 13

documentaries, and one animated film) and 24 short films (15 fiction, five documentaries, and six animated films) (ICA, 2021a, 2021b, 2022a, 2022b, 2023, 2024a, 2024b, 2025a, 2025b).

In 2021, still in the midst of the pandemic, 52 Portuguese films were produced with financial support from the ICA, specifically 32 feature films (15 fiction and 17 documentaries) and 20 short films (11 fiction, three documentaries, and six animated films) (ICA, 2022a, 2022b, 2023, 2024a, 2024b, 2025a, 2025b).

In 2022, 101 national films were produced with financial support from the ICA, specifically 56 feature films (27 fiction, 26 documentaries, and three animated) and 45 short films (20 fiction, five documentaries, and 20 animated) (ICA, 2023, 2024a, 2024b, 2025a, 2025b).

The following year, in 2023, the ICA provided financial support to 98 Portuguese films, specifically 52 feature films (29 fiction, 21 documentaries, and two animated films) and 46 short films (28 fiction, seven documentaries, and 11 animated films) (ICA, 2024a, 2024b, 2025a, 2025b).

Finally, in 2024, the ICA provided financial support for the production of 96 national films, specifically 48 feature films (27 fiction and 21 documentaries) and 48 short films (27 fiction, two documentaries, and 19 animated films) (ICA, 2025a, 2025b).

Distribution and Exhibition of National Films in Movie Theaters in Portugal

Below are some considerations regarding national feature films released and screened in movie theaters in Portugal, as well as the number of viewers and gross box office receipts. In addition, the most-watched feature films in the period under analysis, i.e., between 2019 and 2024, are identified.

Portuguese feature films released and screened

During 2019, 47 Portuguese feature films were released, representing a quarter (25.7%) of the European feature films and 12% of the total (ICA, 2020a, 2020b). Also, in 2019, 196 national feature films were screened, corresponding to 28.2% of European feature films (696 feature films) and 16.5% of the total (1,191 feature films) (ICA, 2020a, 2020b).

In 2020, the first year of the COVID-19 pandemic, only 23 Portuguese feature films were released, less than half the number in the previous year, accounting for 18.5% of European feature films (124 feature films) and 9.5% of the total (241) (ICA, 2021a, 2021b). As for national feature films screened during 2020, there were 133, representing 25.2% of European feature films (528 feature films) and 15.3% of the total (868 feature films) (ICA, 2021a, 2021b). It should be noted that, due to the aforementioned pandemic, Portuguese cinemas, as in the rest of the world, were closed for much of 2020 and 2021.

In the following year, 2021, only 16 Portuguese feature films were released, accounting for 16.5% of European feature films (97 feature films) and 6.6% of the total (244 feature films) (ICA, 2022a, 2022b). It should be noted that, in the previous year, due to the COVID-19 pandemic, Portuguese film production was practically at a standstill. As for feature films shown, 183 were screened that year, representing 34.3% of European feature films (534 feature films) and 20.5% of the total (894 feature films) (ICA, 2022a, 2022b).

In 2022, 53 national feature films were released, accounting for 24.5% of European feature films (216 feature films) and 13.8% of the total (385 feature films) (ICA, 2023). In terms of the number of feature films screened, 197 were shown in 2022, accounting for 29.2% of European feature films (674 feature films) and 17.7% of the total (1,112 feature films) (ICA, 2023).

In 2023, 47 Portuguese-produced feature films were released, representing 26.6% of European feature films (177 feature films) and 13.2% of the total (356 feature films) (ICA, 2024a, 2024b). Regarding feature films screened, during 2023, 201 were nationally produced, representing 29.9% of European feature films (672 feature films) and 17% of the total (1,185 feature films) (ICA, 2024a, 2024b).

In 2024, 62 national feature films were released, corresponding to 30.7% of European feature films (202 feature films) and 15.9% of the total (391 feature films) (ICA, 2025a, 2025b). Of the feature films screened in 2024, 267 were nationally produced, accounting for 35.5% of European feature films (753 feature films) and 20.8% of the total (1,286 feature films) (ICA, 2025a, 2025b).

Number of viewers and gross box office

In 2019, 700,761 viewers went to the cinema to watch Portuguese films, representing 37.1% of European cinema (1,889,168 viewers) and 4.5% of the total (15,540,742) (ICA, 2020a, 2020b). In terms of gross box office receipts for Portuguese films, this reached €3,480,418.04, accounting for 36.3% of gross box office receipts for European cinema (€9,596,575.09) and 4.2% of the total (€83,190,630.67) (ICA, 2020a, 2020b).

In 2020, the first year of the COVID-19 pandemic, Portuguese films were seen by 133,079 viewers, corresponding to 20.6% of European cinema (644,676 viewers) and 3.5% of the total (3,802,661 viewers) (ICA, 2021a, 2021b). With regard to the gross box office takings of Portuguese cinema, it achieved €630,105.93, representing 19.1% of the gross box office takings for European cinema (€3,298,921.81) and 3.1% of the total (€20,567,415.09) (ICA, 2021a, 2021b).

The following year, in 2021, attendance for domestic films reached 164,116 viewers, representing 23.9% of European cinema (687,972 viewers) and 3% of the total (5,480,408 viewers) (ICA, 2022a, 2022b). In terms of gross box office receipts, Portuguese films earned €785,307.39, equivalent to 22.8% of European cinema (€3,449,741.61) and 2.6% of the total (€30,622,161.44) (ICA, 2022).

In 2022, Portuguese films were seen by 532,586 viewers, representing 43.3% of European cinema (1,231,208 viewers) and 5.6% of the total (9,595,884 viewers) (ICA, 2023). In terms of gross box office receipts, Portuguese cinema earned €2,842,494.91, accounting for 43.6% of European cinema (€6,526,623.18) and 5.1% of the total (€55,359,867.18) (ICA, 2023).

In 2023, 328,762 viewers will watch national films, corresponding to 30.5% of European cinema (1,079,496 viewers) and 2.7% of the total (12,290,368 viewers) (ICA, 2024a, 2024b). Regarding the gross box office takings of Portuguese cinema, this reached €1,546,277.05, corresponding to 27.9% of European cinema (€5,542,147.47) and 2.1% of the total (€72,859,758.06) (ICA, 2024a, 2024b).

In 2024, Portuguese films were seen by 533,895 viewers, representing 35.1% of European cinema (1,522,682 viewers) and 4.5% of the total (11,838,962 viewers) (ICA, 2025a, 2025b). In terms of gross box office receipts for Portuguese cinema, it earned €3,071,696.32, accounting for 35.7% of European cinema (€8,614,861.40) and 4.2% of the total (€73,240,708.95) (ICA, 2025a, 2025b).

The most watched Portuguese feature films

As mentioned above, the most watched national feature films in Portuguese cinemas during the period under review, i.e., between 2019 and 2024, will be identified.

For 2019 (ICA, 2020a, 2020b), tenth place went to the film *Gabriel* by director Nuno Bernardo, which premiered on March 21, 2019, with 10,642 viewers and gross box office receipts of €58,164.66. Ninth place went to the film *Diamantino* by directors Gabriel Abrantes and Daniel Schmidt, which premiered on April 4, 2019, attracting 12,040 viewers and grossing €59,676.81. The film *Quero-te Tanto* by director Vicente Alves do Ó came in eighth place, with 12,888 viewers and gross box office receipts of €63,661.22, premiering on April 18, 2019. The next position, seventh, went to the film *Solum* by director Diogo Morgado, which premiered on May 1, 2019, attracting 20,054 viewers and grossing €79,090.04. Sixth place went to the film *Ladrões de Tuta e Meia* by director Hugo Diogo, which premiered on March 14, 2019, with 26,015 viewers and gross receipts of €131,246.93. The documentary *Tony*, which premiered on July 25, 2019, took fifth place, directed by Jorge Pelicano, with 40,477 viewers and €217,204.15 in gross box office receipts. Fourth place went to the film *Tiro e Queda*, directed by Ramón de Los Santos, which reached 43,975 viewers and €233,775.45 in gross box office receipts, released on January 17, 2019. The film *A Herdade* by director Tiago Guedes, which premiered on September 19, 2019, took third place, with 74,284 viewers and €384,555.53 in gross box office receipts. Second place went to the film *SNU* by director Patrícia Sequeira, which premiered on March 7, 2019, with 83,019 viewers and €437,733.10 in gross revenue. The most-watched film in 2019 was *Variações* by director João Maia, which premiered on August 22, 2019, attracting 278,826 viewers and grossing €1,490,564.54.

In relation to 2020 (ICA, 2021a, 2021b), tenth place went to the film *Patrick* by director Gonçalo Waddington, which premiered on July 23, 2020, with 1,486 viewers and gross earnings of €7,369.32. The ninth position was occupied by the film *Surdina* by director Rodrigo Areias, which premiered on July 9, 2020, with 1,679 viewers and gross receipts of €5,717.13. The film *Amor Fati* by director Cláudia Varejão came in eighth place, with 2,416 viewers and gross receipts of €12,408.11, premiering on November 12, 2020. Seventh place went to the film *Sol Posto* by director Ricardo Oliveira, which premiered on November 20, 2020, with 2,502 viewers and gross receipts of €16,631.68. Sixth place went to the documentary *Zé Pedro Rock'n'Roll* by director Diogo Varela Silva, which premiered on July 30, 2020, with 3,696 viewers and gross receipts of €20,103.71. The film *Mosquito*, which premiered on March 5, 2020, took fifth place, directed by João Nuno Pinto, with 3,746 viewers and €17,534.53 in gross box office receipts. Fourth place went to the film *Ordem Moral*, directed by Mário Barroso, with 11,186 viewers and €58,833.28 in gross box office receipts, released on September 10, 2020. The film *O Ano da Morte de Ricardo Reis* by director João Botelho, which premiered on October 1, 2020, came in third place, with 12,051 viewers and €65,090.47 in gross box office receipts. Second place went to the feature film *O Filme do Bruno Aleixo* by directors Pedro Santo and João Moreira, which premiered on January 23, 2020, with 24,190 viewers and €129,989.47 in gross box office receipts. *Listen*, by director Ana Rita Rocha de Sousa, was the most-watched feature film in 2020. It premiered on October 22, 2020, attracting 42,133 viewers and grossing €232,351.73.

As for 2021 (ICA, 2022a, 2022b), tenth place went to the film *Diários de Otsoga* by directors Miguel Gomes and Maureen Fazendeiro, which premiered on August 19, 2021, with 1,507 viewers and gross box office receipts of €7,639.31. Ninth place went to the film *Listen* by director Ana Rita Rocha de Sousa, which premiered on October 22, 2020, and was the most-watched Portuguese feature film in 2020, reaching 1,722 viewers and grossing €4,473.96. The film *O Movimento das Coisas* by director Manuel Serra took eighth place, with 1,834 viewers and gross

box office receipts of €8,220.35. It premiered on June 17, 2021. Seventh place went to the film *Terra Nova* by director Artur Ribeiro, which premiered on October 28, 2021, with 2,757 viewers and €15,035.93 in gross revenue. Sixth place went to the film *Prazer, Camaradas!* by director José Filipe Costa, which premiered on May 20, 2021, reaching 3,266 viewers and grossing €9,733.16. The film *Paraíso*, which premiered on September 16, 2021, took fifth place, directed by Sérgio Tréfaut, with 3,382 viewers and €16,764.20 in gross box office receipts. Fourth place went to the film *Sombra*, directed by Bruno Gascon, which reached 11,600 viewers and grossed €59,199.40, premiering on October 14, 2021. The film *A Metamorfose dos Pássaros* by director Catarina Vasconcelos, which premiered on October 7, 2021, took third place, with 13,517 viewers and €69,156.81 in gross revenue. Second place went to the film *Irregular* by director Diogo Morgado, which premiered on November 18, 2021, with 15,016 viewers and €79,072.07 in gross revenue. The most-watched film in 2021 was *Bem Bom* by director Patrícia Sequeira, which premiered on July 8, 2021, reaching 88,803 viewers and grossing €483,027.31.

With regard to 2022 (ICA, 2023), tenth place went to the documentary film *Cesária Évora* by director Ana Sofia Fonseca, which premiered on October 27, 2022, attracting 7,329 viewers and grossing €40,880.91. The ninth position was occupied by the film *O Homem Que Matou Don Quixote* by director Terry Gilliam, a European co-production between Portugal, France, Spain, Belgium, and Great Britain, which premiered on February 17, 2022, with an attendance of 7,513, , and a gross revenue of €40,049.01. The film *Alma Viva* by director Cristèle Alves Meira ranked eighth, a European co-production between Portugal, France, and Belgium, with an attendance of 7,685 viewers and a gross revenue of €32,562.07, which premiered on November 3, 2022. The next position, seventh, was occupied by the film *O Natal do Bruno Aleixo* by directors Pedro Santo and João Moreira, which premiered on December 22, 2022, achieving an attendance of 8,103 viewers and gross box office receipts of €44,895.58. Sixth place went to the film *O Pai Tirano* by director João Gomes, which premiered on July 21, 2022, reaching an attendance of 9,361 viewers and gross receipts of €49,893.44. The film *Restos do Vento*, which premiered on September 22, 2022, took fifth place, directed by Tiago Guedes, with an attendance of 11,759 viewers and gross receipts of €61,073.37. Fourth place went to the film *A Fada do Lar* by director João Maia, which reached an attendance of 14,843 viewers and grossed €75,805.37. It premiered on October 6, 2022. The film *Salgueiro Maia - O Implicado* by director Sérgio Graciano, which premiered on April 14, 2022, took third place, achieving an attendance of 16,874 viewers and gross receipts of €87,974.42. Second place went to the film *2 Duros de Roer* by director Victor Santos, which premiered on July 14, 2022, with 49,858 viewers and gross receipts of €277,064.33. Finally, the most-watched film in 2022 was *Curral de Moinas - Os Banqueiros do Povo* by director Miguel Cadilhe, which premiered on August 11, 2022, reaching 315,968 viewers and grossing €1,783,334.59.

As for 2023 (ICA, 2024a, 2024b), tenth place went to the film *A Minha Casinha* by director António Sequeira, a co-production between Portugal and Great Britain, which premiered on December 14, 2023, attracting 4,848 viewers and grossing €28,361.79. Ninth place went to the film *A Sibila* by director Eduardo Brito, which premiered on October 12, 2023, attracting 6,680 viewers and grossing €26,833.70. The film *Great Yarmouth - Provisional Figures* by director Marco Martins, a co-production between Portugal, France, and Great Britain, ranked eighth with an attendance of 6,857 viewers and a gross revenue of €36,362.45. It premiered on March 16, 2023. Seventh place went to the film *Não Sou Nada - The Nothingness Club* by director Edgar Pêra, which premiered on October 26, 2023, achieving an attendance of 7,254 viewers and gross receipts of €30,330.87. Sixth place went to the film *O Último Animal* by director Leonel Vieira, a co-production between Portugal and Brazil, which premiered on November 30, 2023, reaching an attendance of 7,859 viewers and gross receipts of €47,641.56. The film *Viver Mal*, a co-production between Portugal and France, which premiered on May 11, 2023, took fifth place,

directed by João Canijo, with an attendance of 12,945 viewers and gross receipts of €59,786.50. Fourth place went to the film *Amadeo* by director Vicente Alves do Ó, which reached an attendance of 13,491 viewers and grossed €62,335.09. It premiered on January 26, 2023. The film *Mal Viver* by director João Canijo, a co-production between Portugal and France, which premiered on May 11, 2023, took third place, with an attendance of 17,441 viewers and gross receipts of €81,894.24. Second place went to the film *Um Filme do Caraças* by director Hugo Diogo, which premiered on August 17, 2023, with 24,572 viewers and €141,137.97 in gross revenue. The most-watched feature film in 2023 was *Pôr do Sol: O Mistério do Colar de São Cajó* by director Manuel Pureza, which premiered on August 3, 2023, reaching 118,671 viewers and grossing €693,291.63.

Around 2024 (ICA, 2025a, 2025b), tenth place went to the film *Cândido - O Espião que Veio do Futebol* by director Jorge Paixão da Costa, which premiered on May 9, 2024, attracting 4,475 viewers and grossing €15,771.57. Ninth place went to the film *Os Papéis do Inglês* by director Sérgio Graciano, which premiered on October 24, 2024, with an attendance of 4,643 viewers and gross receipts of €27,655.14. The film *A Flor do Buriti* by directors João Salaviza and Renée Nader Messora, a co-production between Portugal and Brazil, came in eighth place, with an attendance of 6,368 viewers and a gross revenue of €30,845.40. It premiered on March 21, 2024. The next position, seventh, went t , awarded to the film *O Pior Homem de Londres* by director Rodrigo Areias, which premiered on February 8, 2024, reaching an attendance of 7,672 viewers and gross receipts of €37,928.85. Sixth place went to the film *Gran Tour* by director Miguel Gomes, which premiered on September 19, 2024, achieving an attendance of 11,877 viewers and a gross box office of €65,011.60. The film *A Semente do Mal*, which premiered on January 18, 2024, took fifth place, directed by Gabriel Abrantes, with an attendance of 16,998 viewers and gross receipts of €102,888.57. Fourth place went to the film *Revolução (Sem) Sangue* by director Rui Pedro Sousa, which attracted 20,991 viewers and grossed €113,599.67. It was released on April 11, 2024. The film *Vive e Deixa Viver* by director Miguel Cadilhe, which premiered on October 31, 2024, took third place, with an attendance of 30,705 viewers and gross receipts of €193,475.83. Second place went to the film *Podia Ter Esperado por Agosto (*I Could Have Waited for August) by director César Mourão, which premiered on July 18, 2024, with 102,968 viewers and €632,768.97 in gross revenue. The film *Balas & Bolinhos: Só Mais uma Coisa* by director Luís Ismael, which premiered on August 15, 2024, was the most watched film in 2024, reaching 248,754 viewers and grossing €1,569,235.18.

Conclusion

Between 2019 and 2024, the ICA provided financial support for the production of 462 Portuguese films, distributed among 250 feature films (131 fiction, 113 documentaries, and six animated films) and 212 short films (117 fiction, 26 documentaries, and 71 animated films). It is important to note that 248 fiction films, 139 documentaries, and 77 animated films received support. Although 2020 and 2021 were very difficult years, particularly due to the COVID-19 pandemic, recent years have been very positive in terms of Portuguese film production.

In terms of feature films released, the highest number was in 2024, with 62 releases, and, conversely, the lowest number was in 2021, with only 16 releases. Consequently, the highest market share for feature films released was in 2024, with 15.9%, and, conversely, the lowest share was in 2021, with 6.6%.

As for the number of viewers who attended national films in Portuguese cinemas, it was found that the highest number was reached in 2019, with 700,761 viewers, and, in contrast, the lowest number was obtained in 2020, with 133,079 viewers. However, in terms of market share of

viewers, the highest share was in 2022, with 5.6%, and the lowest in 2023, with 2.7%. It should be noted that the most watched film was *Variações*, by director João Maia, reaching 278,826 viewers in 2019.

Regarding the gross box office takings of Portuguese cinema, it was found that the highest value was achieved in 2019, with a value of €3,480,418.04, and the lowest was obtained in 2020, with a value of €630,105.93. However, in relative terms, the highest market share was in 2022, with 5.1%, and, conversely, the lowest share was in 2023, with 2.1%.

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Portuguese Animation Cinema in the 21st Century: Growth, Recognition, and Audience Challenges

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Introduction

Animated cinema has experienced extraordinary moments in recent decades, with new production companies emerging, new techniques being developed, and new animators entering the field. In the case of Portuguese animated cinema, the last two decades have also seen remarkable growth, both in production and in international recognition, achieving, for the first time in 2023, an Oscar nomination and winning dozens of international awards.

However, in the particular case of Portuguese animated film, despite international recognition (Bendazzi, 2016), it seems to face, among other things, the challenge of content globalization (Jenkins, 2006), wher r productions such as those of Disney or Studio Ghibli dominate the youth imagination (Wells, 2002), which subsequently has an impact on the adult imagination.

This gave rise to the idea of developing an initial exploratory study that aims to analyze this apparent contradiction by examining the perception that young Portuguese people have of national animation and their audiovisual consumption habits.

To structure this analysis, this text is organized into six main sections. Following this introduction, which contextualizes the object of study and its objectives, there is a brief historical contextualization of Portuguese animated cinema, highlighting its main milestones and transformations over the course of a century. The third section describes the methodology adopted, including the definition of the sample, the data collection instruments, and the variables analyzed. The fourth section presents the data collected and its respective analysis, focusing on the consumption habits and level of knowledge of students regarding national animation. The fifth section discusses the results in light of the theoretical framework and the current landscape of audiovisual production and reception. Finally, the sixth section offers a concluding summary, points out the limitations of the study, and proposes perspectives for future research.

Background and context

Animated cinema or animated image cinema (to be more precise) in Portugal celebrated its centenary in 2023, taking as its inaugural milestone the short film "O Pesadelo de António Maria" (1923) by Joaquim Guerreiro (Gaio, 2001). Over the course of a hundred years, Portuguese animation has gone through various stages: from its beginnings linked to revue theater, through a phase marked by advertising production during the Estado Novo, to the emergence of a generation of authors who have won awards at leading festivals such as Annecy, Clermont-Ferrand, and Cartoon D'Or (Cambraia, 2022; Gonçalves, 2017).

Filmmakers such as Abi Feijó, Regina Pessoa, and José Miguel Ribeiro (Castro, 2020) have contributed to consolidating an auteur identity in national animation. However, studies focusing on the reception of this art by the public—especially young audiences—remain scarce (Silva, 2022). This work therefore lies at the intersection of film studies, communication, and cultural sociology, with the aim of understanding how Portuguese animation is perceived (or rendered invisible) by new generations.

Research question and objectives

The research question for this study was: What is the perception of young Portuguese people regarding national animation?

Based on this question, the following objectives were established:

- To analyze the film and audiovisual consumption habits of young Portuguese students of Multimedia Communication, with special emphasis on the consumption of animated films and series;
- To evaluate the selected audience's level of knowledge and appreciation of Portuguese animated films;
- To identify obstacles to greater dissemination and recognition of national animation among young people;
- Propose possible strategies to increase the visibility and reach of Portuguese animated films among this segment.

Justification and originality

This study presents an original approach by focusing not only on the production or recognition of Portuguese animated films, but also on the perspective of its internal audience. At a time when Portugal is celebrating the centenary of animation and national works are achieving unprecedented international recognition, it is pertinent to investigate how these works are (or are not) appropriated by young Portuguese people.

As described in the section on methodology, the research is based on empirical data collected through a questionnaire administered to higher education students in the field of communication and multimedia, offering an up-to-date reading of their habits, preferences, and lack of knowledge. By crossing cultural memory with contemporary consumption challenges, this article aims to contribute to a broader debate on the democratization of access to national film culture.

Finally, the organization of this chapter is presented, consisting of seven complementary sections. Section 1 outlines the problem, the research question, and the objectives, placing them within their theoretical framework. Section 2 provides a historical context for Portuguese animated cinema throughout its first century, identifying the main phases of production and recognition. Section 3 describes the methodological process in detail: case study design, sample, instruments, and questionnaire validation. Section 4 presents and interprets the empirical data, distributed by consumption habits, knowledge of authors, works, and festivals. Section 5 discusses the results in light of the literature on audiovisual globalization and proposes strategies for promoting Portuguese animation. Section 6 then points out the limitations of the study, while section 7 outlines perspectives for future research. Finally, the chapter concludes with a list of bibliographic references that support the analysis.

Historical contextualization of Portuguese animated cinema

Despite some debate in the Portuguese film community, the idea that the short film "O Pesadelo de António Maria" (Guerreiro, 1923) is the first Portuguese animated work has become widely accepted (Gaio, 2001). This satirical piece, shown in the context of revue theater, remained forgotten for decades and was only recovered in the 21st century thanks to the discovery of drawings in the archives of the CINANIMA festival (Gaio, 2001).

This issue is of particular interest, as "A Lenda de Miragaia" (1930) was long considered to be the first Portuguese animation, as documented in Luís de Pina's "História do cinema português" (1986).

In recent decades, the historiography of Portuguese animation has been enriched by research such as that of Cambraia (2022) and Gonçalves (2017), which offer detailed perspectives on its evolution. However, researching the history of Portuguese animated cinema is particularly difficult. On the one hand, because it is necessary to better define the boundaries of animated cinema. On the other hand, because there is a lack of empirical research on the subject that systematizes thinking and generates more in-depth debates. In this regard, there are few published works, among which António Gaio's "História do Cinema Português de Animação: Contributos" (2001) stands out as the first work of considerable scope dedicated exclusively to the subject. More recently, other complementary works and some sections in theses and dissertations have appeared, but even so, greater systematization of information on the subject is necessary, such is the amount of scattered fragments on Portuguese animated cinema.

In analyzing this first century of animated film in Portugal, we can organize its history into five phases, which are briefly described below:

- From the origins to the 1940s

The early decades of animated cinema in Portugal were marked by auteur works such as Tip Top (1925), A Camel's Tale (1930), and The Legend of Miragaia (1930), the latter previously considered the first Portuguese animation. Also noteworthy in this period are O Boneco Rebelde (1941) and Automania (1943), which won the Gallo de Oro award, demonstrating the vitality of the sector despite the context of dictatorship and war.

- Animation and advertising (1940s to 1980s)

Between the 1940s and 1980s, Portuguese animation was closely linked to advertising, with the emergence of studios such as Kapa, Cineca, and Prisma. Production was often carried out independently, under a model known as "ghost," which was later offered to brands. Noteworthy in this context is the Annecy award given to O Melhor da Rua (1967) by Artur Correia.

During the dictatorial regime, censorship and the lack of specialized training limited artistic development. It was only in the 1980s, with the support of grants from the Gulbenkian Foundation and the creation of the Portuguese Film Institute (IPC)—established by Law 7/71, but de facto operational in 1973 (Bénard da Costa, 2007)—opportunities arose to study abroad, benefiting animators such as Abi Feijó, Pedro Serrazina, and Marina Estela Graça.

The arrival of television in 1957 also boosted animated production, notably the series O Romance da Raposa (1987-88). Vasco Granja also played a key role in the dissemination of animation, with programs broadcast on RTP between 1974 and 1990, which presented productions from various countries to a wide range of audiences. During this same period, the

first national animated film festival, CINANIMA, was launched, aimed at giving a voice to a whole generation of new animators and filmmakers (Gil, 2019).

- Crisis (1980s and 1990s)

Despite significant growth in production and visibility—driven, among other factors, by the creation of the CINANIMA festival in 1977 (Gil, 2019)—the sector began to face difficulties in the 1980s. National economic crises, changes in the advertising market, and the entry of multinationals into Portugal reduced the demand for local animation. Production became more limited, and animated commercials gave way to live-action pieces.

- New vitality (late 20th century and early 21st century)

The end of the 20th century brought greater stability in funding and the emergence of new festivals, such as MONSTRA (in 2001). Notable works include A Suspeita (1999) by José Miguel Ribeiro, which won dozens of international awards, and História Trágica com Final Feliz (2005) by Regina Pessoa, which won an award at Annecy. The period was also characterized by an increase in academic production and the creation of some training opportunities in higher education.

However, the economic crisis of 2008 brought the sector to a halt once again, with funding cuts and a general contraction of the economy.

- International recognition and new authors (last decade)

The last decade has been marked by a new cycle of growth. New production companies have emerged—many of them founded by young people—which have expanded the international presence of Portuguese animation. Works such as Carrotrope (2013), Fuligem (2014), Entre Sombras (2018), O Homem do Lixo (2022), and Nayola (2022) have won dozens of awards, nd, in particular, João Gonzalez's short film Ice Merchants (2022), which earned Portugal its first Oscar nomination.

Despite international success, challenges remain: training opportunities are still limited, a clear identity has yet to emerge, and the national audience—especially young people—is unfamiliar with these works. The absence of a solid industry and limited television coverage continue to restrict access to and appreciation of Portuguese animated films.

This is a quantitative, descriptive, and exploratory study that uses empirical data collection techniques and simple statistical analysis. The design is cross-sectional, with data collected at a single point in time, and inductive in nature, with the aim of generating preliminary knowledge that allows for reflection on the phenomenon under study.

Given the exploratory and descriptive nature of the study, no a priori hypotheses were formulated. The main objective was to collect and systematize data that would allow us to understand patterns and gaps in young people's knowledge and appreciation of Portuguese animated films.

As indicated above, the study is aimed at higher education students—specifically those studying for a degree in Multimedia Communication—whose ages are mainly between 18 and 25. The questionnaire was administered before the start of the Animation course, ensuring that responses were free from the influence of formal content on the subject.

The sample consists of 58 students, selected through convenience sampling. Participants were invited to voluntarily respond to a digital questionnaire administered in an academic context. Although this methodological option does not allow for statistical inference to the entire population, it is appropriate for the exploratory nature of the case study and enables the collection of rich and contextually meaningful data. The choice of this sample is justified by the professional profile of the students, who are likely to work in the audiovisual industry and act as future cultural disseminators.

The variables are defined according to the research objectives and correspond to the sections of the questionnaire administered:

- Frequency of cinema attendance and viewing of films/series;
- Frequency of consumption of animated films and series;
- Level of knowledge of national and foreign filmmakers;
- Ability to name animated films, series, and festivals;
- Knowledge of the historical origins of animated films in Portugal.

Frequency of film and audiovisual consumption

The analysis reveals different patterns in the audiovisual consumption habits of the students surveyed, with significant variations between attending the cinema in person and watching films, series, and animated content.

• Going to the cinema

Going to the cinema is not a common practice: 62.1% say they do so rarely, while 29.3% go once a month. Only 6.9% go weekly and 1.7% more than once a week. No participants go daily. These data reflect a shift away from traditional theaters, replaced by more accessible and flexible forms of viewing, such as streaming platforms.

• Watching movies

In contrast, the consumption of feature films in general is considerably more frequent. Most students watch movies monthly (37.9%) or weekly (25.9%), and 19.0% do so more than once a week. Only 10.3% say they rarely watch movies, which shows that cinema, even outside the theater, is still present in leisure habits.

• Watching animated films

As for animation, consumption is less frequent: 39.7% say they rarely watch animated feature films, and 37.9% once a month. Only 12.1% do so weekly and 8.6% more than once a week. This pattern indicates that, despite the international recognition of Portuguese animation, this type of content does not occupy a central place in young people's preferences and is perceived as sporadic viewing.

• Watching series

The series format is the most consumed. Approximately 37.9% say they watch series more than once a week and 15.5% do so daily. This confirms the strong presence of series in young people's

audiovisual routine, especially in a context dominated by streaming, whose model of short, continuous episodes fits in with their consumption dynamics.

• Watching animated series

Animated series show a more evenly distributed consumption pattern: 48.3% rarely watch them, but a significant percentage follow them regularly: 17.2% more than once a week, 12.1% weekly, and 15.5% monthly. These data indicate that animated series—often associated with childhood or anime—maintain a certain presence in youth visual culture, although without a dominant position.

It should be noted that the majority preference for watching films and series is for streaming platforms, with Netflix being the most mentioned by respondents. This shift towards streaming follows the trend observed by Lee, Lee and Baek (2025), which demonstrates the influence of live streaming on the consumption habits of young people.

Knowledge of animated film directors

• Portuguese filmmakers

Most students showed considerable ignorance: 62.1% responded "I don't know," "I'm not familiar with them," "none," or other variations. The most frequently cited Portuguese names were:

– José Miguel Ribeiro (4 mentions);

– João Gonzalez (3 mentions).

Despite the international prestige of their works, their notoriety is not yet significantly reflected among young audiences.

• Foreign filmmakers

The level of recognition is much higher: only 27.6% said they did not know any foreign authors. The most frequently mentioned names were:

– Walt Disney (11 mentions);

– Hayao Miyazaki (4 mentions);

– Henry Selick and Genndy Tartakovsky, among others, with isolated mentions.

Knowledge of animated films

• Portuguese films

39.7% were unable to mention any national titles, which highlights the disconnect between Portuguese production and its reception among young people. The few films mentioned were:

– Ice Merchants (3 mentions);

– Nayola (2 mentions).

- Foreign films

The responses show great diversity, although with only one mention per title, reflecting a wide range of references:

– Coraline, Spirited Away, Tangled, Silent Voice;

– Toy Story, Frozen, Coco, Wall-E, Shrek;

– Your Name, Dragon Ball Z: Fusion Reborn, Spider-Man: Into the Spider-Verse;

– The Raven, The Cave, among others.

Knowledge of festivals and perception of the origin of Portuguese animation

- Portuguese film festivals

Knowledge is very limited and, at times, inaccurate. The most frequently mentioned names were:

– IndieLisboa, Cinanima, and "Cinamina" (2 mentions each);

– Avanca, "Cinenima," Golden Globes, etc. (1 mention).

The phonetic variations ("Cinamina," "Cinenima") reveal partial familiarity, but also a lack of precision.

- Portuguese animated film festivals

The lack of knowledge is even greater: 39.7% did not mention any. The following stand out:

– Cinanima (4 mentions), the oldest and most renowned animation festival in the country;

– "Cinamina" (2 mentions), probably confused with the previous one;

– Isolated mentions of Monstra, Avanca Film Festival, and vague names such as "Disney."

- Historical perception of the origin of Portuguese animation

The responses were scattered:

– 1930 was the most frequently mentioned decade (11 responses), followed by 1920 (10), 1960 (8), and 1910 (7);

– The rest were spread between 1950, 1940, 1900, 1970, and even 1890.

Conclusions

This research sought to understand how young Portuguese people relate to national animated films at a time when this art form is enjoying remarkable recognition and international . Analysis of the data collected from university students revealed a clear asymmetry between the external prestige achieved by Portuguese works and authors and the visibility and appropriation of this production by young audiences.

It was found that cinema attendance is low and that audiovisual consumption occurs mainly through digital platforms, dominated by series and, to a lesser extent, by films. Animation—both in film and series format—occupies a secondary place in consumption habits and is perceived as occasional content. When analyzing knowledge of national authors, films, and festivals, the data is even more revealing: more than half of those surveyed were unable to name any Portuguese animation filmmakers, and an equally significant percentage were unaware of national films or events related to the sector.

The results fully confirm the scenario outlined in the initial question: young Portuguese people show a low level of contact with, knowledge of, and appreciation for animated films made in Portugal. This reality is part of a broader context of globalization of audiovisual consumption, in which American and Japanese products, widely promoted and disseminated in digital media and social networks, predominate. The dominance of brands such as Disney, Pixar, Studio Ghibli, and Netflix not only translates into popularity, but also into the consolidation of a visual imaginary that shapes the tastes, expectations, and cultural habits of new generations.

On the other hand, the Portuguese animated film ecosystem itself faces structural obstacles that hinder its dissemination among young audiences. The lack of communication strategies adapted to digital media, limited presence on the most popular streaming platforms, lack of regular cultural mediation initiatives in schools and universities, and insufficient specialized training contribute to this invisibility. Added to this is the absence of a recognizable identity that differentiates Portuguese animation on the international scene, unlike Japanese animation, which has built its own stylistic and narrative brand.

Given this diagnosis, there is a clear need to implement more effective strategies to promote national animation among young people. Possible solutions include integrating content on Portuguese animation into school and university curricula, creating nationally curated thematic catalogs on streaming platforms, investing in digital outreach campaigns with influencers and content creators, and strengthening the role of public television and festivals as cultural mediators. Such measures can bring young audiences closer to the aesthetic, historical, and narrative richness of Portuguese animation, ensuring its appreciation not only abroad but also among those who can give it continuity locally.

In summary, the results show that the preponderance of transnational streaming platforms (e.g., Netflix, Disney+), whose catalogs favor American and Japanese productions (Lotz, 2017), is a determining factor in young people's lack of knowledge about Portuguese animation. This global dynamic, coupled with the absence of curation of local content on these platforms (Hesmondhalgh, 2019), not only marginalizes national production but also reproduces cultural asymmetries already identified in other contexts (Miller & Yúdice, 2002). To reverse this situation, active cultural policies are required that include: (1) the mandatory integration of national works into the platforms' recommendation algorithms; (2) partnerships with digital influencers for targeted dissemination; and (3) the creation of quality labels that highlight Portuguese animation as a distinctive product. These strategies, aligned with successful experiences in countries such as Canada (Furniss, 2016) and South Korea (Jin, 2020), must be based on up-to-date data on the national audiovisual sector.

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Memes, AI, and politics 2.0: Luigi Mangione's *fandom* on social media

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Introduction

In recent years, Generative Artificial Intelligence (GAI) technologies have evolved exponentially, both in terms of their performance and level of development and in terms of their accessibility to the general public without professional technical knowledge (Galuszka, 2024, pp.605-606). Although the introduction of "intelligent" computer technologies in the aesthetic field began to spread widely in the early 21st century (Arielli, in Manovich and Arielli, 2021, p.4), the COVID-19 pandemic could be considered an important turning point for the current popularization of GAI. This crisis, with its isolation quarantines and lack of interpersonal contact, pushed a large part of the public to seek socialization through these and other digital channels (Gainey, 2024, p.116).

On the other hand, although *online fandom* communities have been present on the Internet since the creation of Web 2.0 (Jenkins, 2006, p.142), the coronavirus situation also greatly boosted the creation, growth, and resurgence of certain digital communities of various kinds, especially among Generation Z and *millennials*. During this period, there was a clear increase in Internet addiction among users globally (Ballarotto, 2021, pp.3-4; Priego Parra et al., 2020, p.11), as well as the increase in active participants in the creation and consumption of content, typical of "mass self-communication" (Castells, 2013, pp.11-12) in the *online* sphere. That is, the well-known *prosumers* (Toffler, 1980) and *emirecs* (Cloutier, 1973) modified their consumption habits by increasing their daily screen time, remaining "*chronically* online" (Vangelos, 2025).

In relation to the content created and consumed by members of the fan universe in the post-COVID context, we find that AI plays a relevant role in the field of content creation on the Internet (Atkinson and Barker, 2023, p.1055; Park et al., 2024, 1). Given the continuous development of IAG tools such as Chat-GPT or Midjourney and the progressive democratization of their use by users without technical training, this has led to their expansion into a wide variety of fields, such as education (García Peñalvo et al., 2024, pp.7-8) and journalism (Peña Fernández et al., 2023, p.3). This technical and technological development, together with the increase in users who actively drive multiple *online* communities, has encouraged members of *fandoms* to use various IAGs to create content for social networks (De la Torre Espinosa and Blázquez Jordán, 2024, pp.77-79).

In this current and effervescent context of cyber communities of users on social media, one of the most interesting fan phenomena the world has seen in recent times has been that built around Luigi Mangione. He is the young American accused of murdering the CEO of UnitedHealthcare, the leading health insurance company in the United States (Sánchez-Vallejo, 2024). Thousands of fan accounts have been created on social media and millions of posts dedicated to Mangione, turning him into a new kind of *celebrity* known around the globe. Thus, the alleged criminal has gained a number of *online* defenders with much more influence than his detractors.

In light of all this, this chapter will address how IAG intervenes in the creation of content associated with this *fandom* on social media, specifically on Instagram and TikTok. These social networks have been chosen because they are among the five most popular worldwide, with two billion and more than 1.6 billion users respectively, and both have around 60% of users aged between 18 and 34 (Statista, 2024; 2025), a range that includes the aforementioned Generation Z and Millennials. The research question that will guide this study is therefore: What role do posts created with IAG play in the landscape of content shared on Instagram and TikTok about Luigi Mangione?

This chapter seeks answers to the question posed through virtual ethnography (Hine, 2000; Sádaba, 2022), conducting a case study of posts produced by IAG on Instagram and TikTok within the Luigi Mangione *fandom*. A quantitative and qualitative analysis is carried out on 38 video posts made with AI obtained from the selected social networks, from an initial population of 445 posts resulting from a general *hashtag* search. The following sections explain the methods used to select the sample and analyze it, as well as the interpretation of the results obtained.

Through this research, we aim to contribute to the scientific literature that studies the role of Artificial Intelligence in sociocultural and aesthetic construction in the field of social media, given the importance that these technologies are achieving in various areas (Flórez Ibarra and Kuo Ying, 2025, p.53) and the interest that Internet communities such as *online fandom* are generating in the academic field.

Luigi Mangione, new mass phenomenon: participatory culture and politics 2.0

The world met Mangione in December 2024 when the first image of his face, partially captured by a security camera before the murder of Brian Thompson, of which he is accused, was released. Thompson was the acting CEO of UnitedHealthcare. When the image was released, the identity of the alleged killer was not yet known. However, there was a detail in the crime scene that began to provoke a certain admiration for the attacker: the words "deny," "defend," and "depose" engraved on the three bullets he fired at Thompson, which police investigations link to "a reference to what are known as 'the 3 Ds' of the health insurance industry in the United States," a strategy of denying healthcare needs to the majority of customers (Debusmann, 2024). This element gave the crime an openly political and critical character against the management of the privatized healthcare system in the United States and was the first step in the mythification of the alleged culprit.

A few days after the crime, Mangione was arrested in the state of Pennsylvania. Once in police custody, new details of the case began to emerge: both the gun and the silencer carried by the suspect (and allegedly used in the murder) had been manufactured using 3D printing. In addition, a handwritten document was found among his belongings that authorities described as a "manifesto" strongly criticizing the US healthcare system. Finally, the identity of the detainee was revealed: Luigi Mangione, a young Italian-American in his twenties from a wealthy family in Maryland and a brilliant computer engineering student at the University of Pennsylvania.

All the new information that reached the public through the media only fueled the interest of those following the case, and an intense debate ensued, which is still ongoing in public opinion, about the moral issues surrounding it. While some of the public criticizes and condemns his actions, there are those who staunchly defend him and proclaim him a revolutionary hero, both *online* and in the streets. Thus, Mangione has sparked a worldwide "fan explosion" (Álvarez Barba, 2025) that is worthy of study. In analyzing this phenomenon, this chapter draws on Henry

Jenkins' (1992; 2006) theories of participatory culture and media convergence, as well as those of Politics 2.0 (Gómez Castellanos et al., 2022).

The case study is particularly interesting from the perspective of the latter concept, since, behind the crime committed, there is a political message against the privatization of the healthcare system in the United States. This means that some of the content created and shared by his admirers and detractors may imply a certain political stance for or against Mangione's act, becoming part of politics 2.0, that is, the *online* public space where the opinions of both political actors and ordinary users converge (Martínez Rolán and Piñeira Otero, 2017, pp.56-57).. In politics 2.0, all types of users engage in debates and conversations on various topics of this nature in the same environment, finding themselves on an equal footing to transform public opinion.

In addition to taking into account this characteristic of Luigi Mangione's *fandom* content on social media, this chapter studies this phenomenon from the perspective of communication theories through what Henry Jenkins called "participatory culture" in *Textual Poachers: television fans and participatory culture* (1992, p.46). In this book, Jenkins explains his view of fans as dynamic readers who, far from settling for the canonical narratives offered to them by the entertainment industries, create their own universe using those narratives as a basis (pp. 23-24). In this way, as good "*textual* poachers" (Jenkins and Capel Tatjer, 2010), Mangione's fans expand the narrative universe that frames him, creating and sharing *fan fiction* and other products such as *fan-made videos*, *fan art*, and memes on social media. The content created by his followers ranges from defending his cause from a political and activist perspective to an almost obsessive admiration for his story and personal characteristics and his sexualization, as if he were a Hollywood star.

On the latter point, Jenkins (1992) notes that one of the main features of *fandom* is the exploration of the erotic aspect of fictional characters in the narrative universe of which one is a fan (p. 175). In the *online* sphere, these communities tend to explore the sexual and erotic dimension not only of fictional characters, but also of celebrities (Jenkins, 2006, p.142), and this applies to any type of public figure capable of generating a fan community. Even in *fandoms* of figures such as serial killers, there is a marked tendency to sexualize and romanticize criminals (Smith, 2018, pp.140-141; Fathallah, 2023, p.64).

With regard to the relationship between Mangione's *fandom* expressions and media convergence, there are a number of examples that highlight how this operates. His mugshot, which shows his face from the front with a serene expression, has been used by various artists and fans to represent him pictorially through iconographic elements of Christianity as "Saint Luigi," patron saint of justice in health. This representation of Mangione, along with many others, has gone viral on social media and has also spread *offline* globally, appearing on T-shirts, candles, *graffiti*, posters, and banners hung on building walls in cities such as London, Sydney, Barcelona, and Chile. This is a clear example of how media convergence operates in the expressions of Mangione's fans.

Another example of media convergence in this case is the representation of the defendant in various satirical *edits* and memes, dressed in the green outfit characteristic of Luigi, one of the protagonists of the *Mario Bros.* universe, and even referring to Mangione through the image of the video game character himself. As with the image of Saint Luigi, this viral meme has transcended to the streets through, once again, expressions such as *graffiti*, posters, and other types of urban art. In this way, the fictional character has been given a meaning totally different from the original after the reinterpretation of his narrative by his fans.

With regard to the use of AI by *fandoms*, studies such as that by Eva Cheuk-Yin Li and Ka-Wei Pang (2024) list some popular trends among fans in the use of these technologies: the creation of *fan art* (drawings or illustrations of the admired subject or universe), the automatic subtitling of audiovisual productions in different languages (for example, the Spanish subtitling of anime series by the Spanish-speaking *fandom*,), the writing of *fan fiction* (fan literature that expands or reinterprets the admired object), and *deepfakes* (pp. 779-780, 782). Regarding this last trend, this and other articles warn of the risks it poses in terms of the potential dissemination of false information and its assimilation by the general public (Romero Moreno, 2024, p.299). On the other hand, Li and Pang (2024) explain how fans have the ability to intervene in the algorithms that operate with artificial intelligence on *online* platforms by creating and sharing content that favors the reputation and visibility of the subject they admire (p.783).

In the content created by Mangione's *fandom*, a general review of *online* publications shows that he has been represented in various formats and with different intentions through AI tools. Some viral *deepfakes* of Mangione depict him shirtless and showing off his muscular torso, others show what he would have become if he had not committed the crime or what he will look like when he gets out of prison, and a fake police photo of the alleged criminal was even created, which went viral and was shared in some media outlets and was soon identified by Reuters as "synthetic media" (Reuters Fact Check, 2024).

In this chapter, we will focus on this type of publication, given the interest aroused both by the use of IAG tools in the construction of cultural products shared on social media and by the Mangione case due to the political debate it has sparked on the Internet. In this way, we will try to conclude which uses of this tool are most popular among the public when it comes to creating, receiving, and sharing content on social media.

Given the context presented in this section, we present the following hypotheses: H1) The proportion of content created by IAG compared to that not using this tool will not be high, but it will be significant; H2) In the posts created by IAG analyzed, *meme* content will abound; H3) Content created by IAG will in many cases be used to sexualize Luigi Mangione; H4) *Posts* made by the *fandom* with IAG will be used as a positive claim for Mangione's reputation.

Analysis of the content of Mangione's fan universe on Instagram and TikTok

For this work, we have adopted a mixed methodological approach, using qualitative and quantitative techniques applied to a specific case study, in this case, the Luigi Mangione *fandom*. To respond to our object of study, we have approached the trends and patterns in the varied fan production that the Luigi phenomenon has brought with it from a communicational perspective.

These mixed techniques are approached from a virtual ethnographic perspective together with the application of content analysis. The choice of this method responds to the characteristics that, on the one hand, Sádaba (2022, p.470) defines for the study of cultural phenomena, regardless of their form and content, generated by online communities. This perspective has been applied over time to *fandom* studies (Guerrero Pico, 2016, pp.97-98) to understand the behavioral dynamics and interactions generated by users of a given cultural sphere. Together with the incorporation of the quantitative component through content analysis, we have been able to design a comprehensive methodological framework that allows us not only to observe

cultural practices in their digital context, but also to identify and quantify recurring themes, predominant narrative forms, and patterns of participation linked to the use of generative artificial intelligence in content creation.

In order to understand how IAG tools can be used by Luigi Mangione's *online* fan community to generate ideas and/or opinions on a real political case, we decided to adopt a non-participatory observation approach by recording and coding the data found on Instagram and TikTok. This coding was carried out in accordance with the criteria that all content analysis must meet, considering both primary and secondary content, such as videos and montages uploaded and disseminated on the aforementioned platforms. Following a horizontal logic, that is, collecting a large amount of information without hierarchizing it, we sought to capture the diversity of topics and the social impact generated by these publications.

To develop the observatory, as well as the techniques for collecting, recording, and processing the data, we drew on various works that addressed the analysis of digital community creations (De la Torre Espinosa and Blázquez Jordán, 2024; Martínez Rolán and Piñeiro Otero, 2016; Gomes et al., 2009). To analyze the corpus obtained, we followed the guidelines of Gaitán Moya and Piñuel Raigada (1998, pp. 281-311) for the creation of a coding system that would meet the objectives of this study. The use and application of coding in this type of work is referenced in Torrego-González et al. (2021), from whom we adopted the *coding and counting* method to quantify and detect significant patterns.

Once the coding system had been defined, we proceeded to compile the sample for analysis. To do this, we searched the Instagram and TikTok platforms using five of the hashtags with the highest volume of posts related to the case: #luigimangione, #freeluigi, #luigimangioneourhero, #luigimangioneedits, and #luigimangionememes. On both social networks, the content was filtered through the search options "Reels" on Instagram and "Videos" on TikTok, limiting the selection to the short video format. This choice was justified both by the current prevalence of video on both platforms and by the tradition of fan-vidding in *fandom* communities as a common form of expression (Coppa, 2022). The first 50 posts that appeared for each hashtag on each network were extracted, forming an initial sample of 500 posts. Data collection was carried out during the week of April 21.

After this first phase, the results obtained were entered into a spreadsheet. Posts that had been deleted from at the time of classification, whose content did not correspond to the case of Luigi Mangione, or that were duplicates were eliminated, leaving a final sample of 445 posts. Next, all posts were classified according to the categories established in the code book: "Content origin" (publishing platform), "Format" (image or video, and associated subformats), "Content" (communicative intent, position on the case, presence or absence of sexualization), "Creation tool" (manual, digital, IAG, or combined), and "Impact" (*likes*, comments, views, and shares). Through further filtering by creation tool, 40 posts made using IAG were identified. By limiting the analysis to video format only, the final sample consisted of 38 posts.

In terms of impact classification, although the 445 posts were coded in the other categories, specific numerical values were only recorded for the 38 posts generated with IAG, as this was the central focus of this study. For the remaining 405 posts, the impact was categorized by intervals: 1 for less than 1,000 interactions, 2 for between 1,000 and 10,000, 3 for between 10,000 and 100,000, and 4 for more than 100,000 interactions.

Luigi Mangione's *fandom* through the observed data

The corpus obtained after observing and collecting the content hosted on the Instagram and TikTok platforms was analyzed in the spreadsheet itself, using pivot tables to visualize the values assigned to each question. In this way, we were able to organize and visualize the information in a structured manner, facilitating the identification of trends, frequencies, and correlations between key variables in the study. It should be noted that the data obtained is not representative in statistical terms, but rather responds to a theoretical and exploratory approach. Therefore, its value lies solely in having allowed us to formulate an initial hypothesis about how a specific digital community could be using generative artificial intelligence to position itself, intervene, or remain on the sidelines in a political case.

A first approximation of this use can be seen in the data in Table 1, which reveals a clear predominance of traditional digital creation as the main form of meme production on both platforms. With a percentage exceeding 80% on both Instagram and TikTok, almost all of the content analyzed has been produced by digital creation and editing tools. This trend suggests that, despite the growing interest in generative artificial intelligence (GAI), its use in this type of content is still in the minority (9%), although with a slightly more marked presence on Instagram (11.7%) than on TikTok (6%). Manual creation, i.e., content created without the use of digital media, such as a hand-drawn picture or *graffiti*, appears residually in both environments, which could be linked to the production logic of these platforms, which are heavily influenced by digital creation tools. Finally, it is worth mentioning that content that has followed a combined model (manual/digital + IAG) is less attractive to content creators . Although this category could be considered a variant of IAG use, we have chosen to exclude it from further analysis, as its volume is statistically irrelevant to the subject of study and does not allow representative conclusions to be drawn in relation to the case analyzed.

Table 1. *Distribution of memes by platform and mode of creation.*

Plataforma	Tipo de creación				Total
	Manual	Digital	IAG	Combinada	
Instagram	1,7% (N=4)	83,9% (N = 193)	11,7% (N = 27)	2,6% (N = 6)	100% (N =231)
Tik Tok	7% (N = 15)	85,1% (N = 183)	6% (N = 13)	1,9% (N = 4)	100% (N = 216)
Total	4,3% (N = 19)	84,5% (N = 376)	9% (N = 40)	2,2% (N = 10)	100% (N = 445)

Note: Prepared by the authors.

Given that the IAG category ranks second among the most used tools on both platforms, we set out to learn more about the specific uses that content creators give to this technology. First, we filtered the posts by creation tool and format. Applying this discrimination, we realized that the presence of still images was almost non-existent for content generated by IAG, possibly due to the particularities of these platforms, so we decided to observe how the content behaved in an audiovisual medium.

Our interest in focusing the analysis on video format subtypes is not arbitrary, as they respond to a basic characteristic of the fan phenomenon by being the main vehicle of expression in certain communities, either because of the platforms' own algorithms that facilitate and encourage the

dissemination of video or because of the ease with which these amateur creators can now create their own content. Regardless of the causes, as can be seen in Table 2, memes and so-called "staneo posts" stand out as the most frequent content, mainly using third-party footage without text or stylized visual structures.

Table 2. *Type of content in relation to video subformat by number of posts Generative artificial intelligence.*

Tipo de contenido	Tipo de subformato				Total
	Fan Edits	Otros *fan-made vids*	Metraje ajeno sin texto	Metraje ajeno con texto	
Opinión política	–	1	–	–	1
Opinión activista	–	1	–	–	1
Memes	–	5	13	2	20
Post de "staneo"	2	7	1	2	12
Otros	–	3	–	1	4
Total	2	17	14	5	38

Note: own elaboration.

This content was also examined in relation to the position taken on the Luigi Mangione case in order to detect possible ideological or emotional alignments. Table 3 presents this distribution, distinguishing between neutral, explicitly pro-Luigi, and implicitly pro-Luigi publications. Publications with positions contrary to the character were also considered as a measurable category. However, as can be seen, most of the content maintains a neutral stance, especially in the case of memes. In contrast, favorable expressions, whether explicit or implicit, are less frequent and tend to be concentrated in visual formats such as "staneo" posts.

Table 3. *Content of posts generated by IAG according to their position in the Luigi Mangione case.*

Tipo de contenido	Posición de caso			Total
	Neutral	Pro-Luigi explicito	Pro-Luigi implícito	
Opinión política		1		1
Opinión activista		1		1
Memes	17		3	20
Post de "staneo"	9	2	1	12
Otros	1	3		4
Total	27	7	4	38

Note: Own elaboration.

Along the same lines, we were interested in exploring whether this IAG-generated content also incorporated any elements that tended to sexualize Mangione. We found that, during the course of the case, the internet focused on his physical appearance, fetishizing his beauty and romanticizing his image, something that is very common in cases of this type. Table 4 shows how "staneo" posts tend to account for most cases of sexualization, compared to the majority of

content focused on memes. This gives us an interpretation that we can combine with the impact generated on these networks.

Table 4. *Type of content based on sexualization.*

Tipo de contenido	Sexualización		Total
	Sí	No	
Opinión política		1	1
Opinión activista		1	1
Memes	2	18	20
Post de "staneo"	8	4	12
Otros	1	3	4
Total	11	27	38

Note: own elaboration.

If we look at Table 5, which shows the average impact generated by each type of content, both on Instagram and TikTok, through four variables: *likes*, comments, views, and shares, we can highlight two types of trends. The first corresponds to a trend that we associate with the individual area and is generated by activist opinion posts. According to the data, this type of content accounts for most of the private interactions that users have with each social network. The second trend corresponds to what we identify as the public area and is represented by the "number of shares" indicator through memes.

Table 5. *Average impact values of posts generated by IAG according to their content.*

Tipo de contenido	Impacto en redes sociales			
	Likes	Comentarios	Visualizaciones	Veces compartido
Opinión política	7425,0	146,0	50400,0	149,0
Opinión activista	51200,0	3380,0	381600,0	2863,0
Memes	20238,0	113,2	303402,1	16858,7
Post de "staneo"	12912,5	206,1	291764,4	9938,6
Otros	21,8	2,8	939,0	1,8
Total	16274,2	217,7	263288,7	12090,9

Note: own elaboration.

In view of the data obtained, it can be observed that content generated by generative artificial intelligence, when produced by a specific community within the digital sphere and in relation to a political issue, tends to take on an ambiguous or openly neutral form of expression. This stylistic choice does not seem to respond solely to a lack of positioning, but rather to a communication strategy that prioritizes the circulation, acceptability, and visual impact over direct discursive confrontation. However, this trend does not necessarily guarantee greater visibility: the data show that more ambiguous content does not always achieve the desired reach. On the contrary, messages that explicitly address the political dimension of the case, although less frequent, tend to generate a higher degree of interaction, especially in the form of comments and reactions. This means that there is a kind of contradiction: on the one hand, most AI-generated content prefers a striking but neutral or ambiguous visual style, without taking a clear position. But on the other hand, content that does address political issues directly continues to be powerful and

gets people to interact more. In this sense, artificial intelligence does not make political positions or conflicts disappear, but often causes them to be expressed in a more subtle or indirect way, adapting to the forms of communication that dominate the internet.

The role of AI-generated content in the *fandom* community

At the beginning of this chapter, we proposed a hypothesis about the use of AGI as a means of creation in a digital community, based on the idea that, despite its exponential growth, its adoption would continue to be minority compared to other available tools, although already significant. The data presented in Table 1 suggest that, although digital creation remains the predominant form of content creation on platforms such as Instagram and TikTok, AIG seems to be gradually gaining prominence. This phenomenon can be understood from several points of view.

One of them is the work of Li and Pang (2024, pp. 779-780), which highlights the democratization of purely AI-based creation tools or those that introduce certain elements to help fans participate in the culture of exchange and interaction. Another argument we can deduce is that its dissemination is above average because algorithms can reward or facilitate its dissemination. However, this assessment is not entirely correct because it leads us to believe that the publications generated come from outside the fan sphere. Some authors, such as Kang and Lou (2022, pp. 8-9), mention that TikTok's own algorithm disseminates content created by its users based on criteria of interest rather than genuine connections, which further strengthens the niche from which it originates, individualism, and personal satisfaction rather than the pursuit of general complacency.

However, this complacency, in a media case such as that presented by Luigi Mangione, may not be so well defined as it could be diluted or found in a more open space than other communities. Even so, users familiar with the case tend to contribute to its dissemination without necessarily paying attention to the tool used to generate the content. As Mussies (2023) points out, fans, or even potential fans, do not care how a work was created, as long as it aligns with their own mental vision of the character or phenomenon that brings them together.

However, this does not exclude the importance of the format in which the work is contained. The different types of videos categorized within the sample of posts created with IAG, together with the nomenclature of these categories, respond to a combination of those used in different articles that analyze social media content created by online communities (Ling et al., 2021; Martínez Rolán and Piñeiro Otero, 2016; Pérez Gómez, 2009). *Fan edits* are present, which correspond to a recurring type of video in *fandom* productions in which different video fragments or photographs of the admired subject are edited to give a different narrative to the original, usually with background music. Next, we observe the category of "other *fan-made vids*," which corresponds to a format category that does not include songvids, *mash-ups*, *recuts*, or *fan* trailers (Pérez Gómez, 2009, pp.68-71), but which in one way or another express their belonging to the Mangione *fandom*. Then there are the "foreign footage" videos with and without text, that is, videos from a source other than the filmmaker's own footage, with or without superimposed text.

In terms of content type, we observed a series of subcategories belonging to the "Opinion" tag ("political opinion" and "activist opinion") and "Entertainment" ("staneo posts," memes, and others). The "Information" content category was left out of this table. "Staneo posts" refer to those that express deep admiration for the admired subject and their personal characteristics (Bermúdez et al., 2020, pp.1-2) in different ways, such as posting the latest updates about the

admired person or showing support in any other way. Thus, we observe that the most abundant types of posts made with IAG in terms of content are memes (20 in total) and "staneo posts" (12 in total)

The fact that memes are the most abundant category of content is probably due to the political nature of the case, as it is common in politics 2.0 to satirize political content through this type of content (Gutiérrez Vidrio and Reyna Ruiz, 2020, p.90). Thus, taking into account the content of the memes in question, we could interpret that IAG is a tool that Internet users use extensively to create memes in video format, given its ability to generate humorous, surreal, and other types of situations using *deepfake* technologies. On the other hand, there are many "staneo" posts which, as explained above, express in different ways their fascination with the admired person. As with memes, we observe in these posts how *deepfake* technology is used to create dreamlike situations that represent the chosen subject, emphasizing, above all, their physical attributes. Given the insistence on the use of *deepfake* for the creation of this content, we support the hypothesis put forward by De la Torre and Blázquez that "the development and accessibility of IAG increases the *fandom's* drive for reality" (2024, p.77).

Now, in relation to the eroticization of Mangione's figure, the sexualized production and relatable idolatry in this study is much more evident in publications that do not involve IAG. However, "hybristophilia" is reduced to a purely erotic sphere and does not entail romanticization. According to Table 3, which analyzes the position taken on the Mangione case, although a certain tendency toward support is detected (interpreted as a gesture of "social justice" that reconfigures his figure as a Robin Hood-type hero), this support is mostly implicit rather than explicit. As Table 4 reinforces, content generated with IAG tends to avoid taking a direct stance on the political and social implications of the case, opting instead for formats such as memes and "staneo" posts, which extol him as a visual symbol without the need to articulate a clear ideological message. In this sense, Luigi Mangione is represented more as an iconic and aestheticized figure than as a political subject. However, this category of "staneo posts" is, by definition, prone to idolatry. The sexual or erotic charge surrounding Mangione's figure has been prominent and recognized since the beginning of the case (New York Times, 2024; Honderich and Wendling, 2024). Meanwhile, the aforementioned media articles raise ethical debates about the very existence of the fan phenomenon surrounding his figure and the effect that sexualization may have on the perception of the case in general and the subject in particular. This approach bears similarities to the concept of "aesthetic capital" (Anderson et al., 2010), understood as "any capital that can be used as symbolic if the population recognizes its unequal distribution as legitimate" (Bourdieu, 1991, p.118). From this perspective, we can understand the creation of a *fandom* around his figure, initially sparked by the crime of which he is accused and its relevance, but fostered and viralized by this "aesthetic capital."

Luigi's case differs from others such as Ted Bundy or Jeffrey Dahmer, already established as consolidated subjects of study (Smith, 2018; Fathallah, 2023) for several reasons. Firstly, it is an ongoing investigation, and considering Luigi Mangione a criminal would be an attack on the presumption of innocence, as at the time of this study, the case is still open. Therefore, the content generated can be considered free of moral implications. Furthermore, even if Mangione were found guilty, this is a one-off criminal act and not a serial killer, as are most of the criminals who reap these *fandoms* (Smith, 2018).

One of the aspects that has most caught our attention is the divergence shown by certain types of content in terms of their impact on their respective platforms. While politically charged or critical content has higher individual values, which may offer indirect clues about how the content is received and circulated, satirical content, with its neutral and ambiguous nature, seems to

achieve greater dissemination. There is a wealth of literature addressing aspects related to this phenomenon, including the issue of privacy in the digital environment. Remedios Zafra, in her essay *La (im)posibilidad de un mundo sin párpados* (The (im)possibility of a world without eyelids) (2019), addresses this issue by highlighting one of the main problems of internet overexposure: the constant tension between what to make public and what not to make public, and th tion as an act of dissent in order to preserve that tiny space that the machine can offer us in a hyperconnected world. This reflection is in line with other formalized studies on user behavior in response to sensitive content, which have shown a tendency to anonymize or avoid direct interaction with sensitive posts (Zhang & Kizilcec, 2014). However, the current scenario is even more complex: users have delegated part of their agency to the machine, which, mediated by artificial intelligence, provides them with content without the need for active interaction (Kang and Lou, 2022, pp. 8–9). In this context, silent and passive viewing constitutes a new paradigm in the relationship with content, where reception does not necessarily translate into visible action, and where intimate space seems to have been, at least in part, displaced.

Conclusions

The main objective of this work was to analyze the impact of publications generated by generative artificial intelligence in a specific case: the *fandom* surrounding the figure of Luigi Mangione. To this end, we applied virtual ethnography research techniques to observe the content generated on the Instagram and TikTok platforms in a non-participatory manner. In order to analyze this content systematically, the first 50 posts associated with five relevant hashtags on each of the platforms were collected. This initial collection produced a corpus of 500 posts, which was reduced to 445 after removing duplicates. Subsequently, a coding system was applied and the variables were cross-referenced using spreadsheet software, which allowed us to quantify and organize the data according to the analytical categories designed. This process enabled us to address and answer the research questions posed.

For our H1) *The proportion of content created by GAI versus that not using this tool will not be high, but it will be significant.* Based on the data, we can say that this is confirmed, since although content generated with generative artificial intelligence (GAI) represents only 9% of the total publications analyzed, this proportion is significant in a context where these tools are still in the process of becoming popular. As we have seen, technical democratization has facilitated its adoption by *fandom*, and although it is not the predominant medium, it already constitutes a relevant part of the digital creative production ecosystem.

For our H2) *In the posts created by IAG that were analyzed, meme content will abound.* This is also confirmed, as memes are the most frequent type of content in posts made with IAG, as shown in Table 2. This trend was also noted in our analysis of the results, where we identified that both on TikTok and Instagram, memes and *"staneo"* posts are the dominant categories in the video subformat. As discussed in the body of the chapter, this choice may be related to the intention to create material that spreads quickly and is not particularly controversial, which facilitates its circulation and acceptance within the digital environment analyzed.

For our H3) *The content created by IAG will in many cases be used to sexualize Luigi Mangione.* This is considered partially refuted, as only 29% of posts feature elements of sexualization, and these are concentrated especially in "staneo" posts. These figures do not correspond to "handcrafted" content (not generated with AI), where we can observe a higher incidence of sexualization of Luigi's figure, especially in *edits*. However, looking specifically at the data from IAG-generated elements, most of the content is visually neutral and does not resort to erotic resources. This suggests that, although the aestheticization of the body is a common practice in

some *fandoms*, in this specific case, sexualization is not the predominant function assigned to IAG.

For our H4) *Posts made by the fandom with IAG will be used as a positive claim for Mangione's reputation.* It is considered completely refuted. The analysis shows that most of the content generated by IAG maintains a neutral position on the case. This particularity, compared to the trend among other media criminals such as Ted Bundy or Richard Ramirez, may stem from the fact that the case is still open. In addition, fan-derived production, such as the aforementioned symbols of *Saint Luigi* (the figure embodied in the pantocrator) or his representation as the popular brother of Mario Bros, allows fan content to thrive beyond the trial, taking symbols or representations that end up acquiring meanings and implications unrelated to the case. Thus, Luigi (and what he represents) become two separate elements that users can joke about without commenting on his reputation.

In short, this study shows that generative artificial intelligence is being integrated by *fandom* communities not only as an aesthetic tool, but also as a means of expressing positions, building identity, and managing visibility on social media. Through the case of Luigi Mangione, we present a theoretical approach to how GAI expands the expressive possibilities of *fandom*, allowing for both neutral and viral content as well as more ideological and intimate content that is less shared but has a high impact.

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Exploring digital and media literacy.

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Introduction

Advances and innovations in technology and digital media offer new opportunities for interaction in all aspects of daily life (Bernate and Vargas, 2020). Education is no exception and, in fact, must seek ways to adapt to these transformations to strengthen skills and develop competencies in this area, because in an increasingly interconnected world dominated by the culture of convergence, the ability to navigate, evaluate, and create content across multiple platforms has become an essential skill (Avello et al., 2013; Rué, 2004; Tyner et al., 2015). However, there is a cultural and technological gap between the younger generations and an education system that has not advanced at the same pace as the digital world (Câmara and Steagall, 2021).

In a broad sense, transmedia is a narrative strategy that uses multiple platforms and formats (such as books, films, video games) to tell a story, allowing the audience to interact and explore different aspects of the story. The transmedia approach in language education uses multiple platforms (videos, games, social networks) to teach languages, offering interactive and enriching experiences that improve understanding and learning through various media.

Scolari (2016) introduced the term *transmedia literacy*, which is conceived as a new perspective on the interactions between individuals, ICT, and educational institutions, as well as a set of skills. This analysis explores the transformations in media ecology and the evolution of different types of literacy. As a result, media literacy and digital innovation have become a basic skill for university students, encompassing critical understanding and active participation in content creation, adapting to constant technological and social changes (Moreno et al., 2018).

Studies by Irigaray and Lovato (2018) and Vadillo Bueno (2020) explore how artificial intelligence can enrich transmedia narratives, creating more immersive and personalized experiences for users.

In this context, it is important to critically evaluate the presence of scientific studies and interventions that address the implementation of transmedia practices in university education, specifically in the field of media literacy and digital innovation in language education.

Transmedia practices

The concept of transmedia has been defined as a narrative or project that extends across multiple media platforms, such as social networks, videos, blogs, and games, offering unique opportunities for collaborative creation and active participation (Edmond, 2014). Students should not only be critical consumers of these narratives, but also competent creators capable of designing coherent and engaging transmedia universes (Grandio-Pérez, 2016; Hovious et al., 2021; Palioura and Dimoulas, 2022).

In university education, and more specifically in the field of linguistics, these practices have been used to improve intercultural communication skills (Deardorff, 2006; Sotelo, 2019) by exposing students to different cultures and languages through various media platforms. Authors such as Amici and Taddeo (2018) and Zhu et al. (2020) highlight that the implementation of transmedia

practices motivates students by making activities more engaging and meaningful, while developing their media literacy and digital innovation, providing skills to navigate, evaluate, and create content in different media (Nguyen et al., 2022). Saavedra et al. (2017) emphasize that transmedia practices promote interaction, multimedia, and hypertextuality.

According to Pereira-Salcedo and Estrella-Romero (2024), transmedia communication allows students to interact with diverse content across multiple media platforms, enriching their educational experience. This approach not only facilitates the integration of diverse narratives, but also promotes critical thinking and active student participation.

Recent studies highlight the importance of visuality in university education. For example, Peña-Acuña and Sánchez-Verdejo Pérez (2024) and Biehler et al. (2024) show how transmedia practices and visual approaches improve media and digital literacy, promoting more interactive and effective learning. Visuality in transmedia is crucial for creating immersive and participatory experiences, improving audience understanding and *engagement* (Albarello, 2020). In addition, Peña-Acuña and Jaramillo (2024) explore the use of Instagram and YouTube as pedagogical tools that increase visual culture in higher education.

The controversy surrounding transmedia practices in education centers on the complexity of integrating these practices into teaching-learning processes and the lack of a unified understanding of transmedia learning. The main points of debate and challenges identified in the literature are presented below.

The integration of transmedia learning into education faces challenges due to its complexity, as it requires adapting pedagogical practices to transmedia narratives and principles such as constructivism and connectivism (Sánchez-Caballé and González-Martínez, 2022). Furthermore, although this approach can strengthen student engagement, it can be challenging for digital novices (Dickinson-Delaporte et al., 2020), who may find it difficult to participate fully in transmedia learning communities.

From an educational perspective, transmedia is key to participatory culture (González-Martínez, 2019), as it allows educational objectives to be achieved through narratives. Its learning experiences are authentic, immersive, and foster new literacies (Rodríguez and Bidarra, 2014), which are fundamental in the digital age.

In terms of opportunities, this approach promotes collaborative and engaged learning (Tombleson, 2024) by integrating multiple platforms. It also acts as a bridge to media literacy (Gallo et al., 2013) by connecting media interaction with cognition and enriching formal education.

Media literacy

This is the ability to access, analyze, evaluate, and create messages in various media (Lee & So, 2014), which can range from print media to digital platforms. It involves a critical understanding and effective production of media content, not just the instrumentalization of education in technologies (Hernández-Santaolalla et al., 2017). In the context of language education, media literacy takes on particular relevance for understanding the impact of the media on written language and culture, as well as understanding how the media influence the way messages are constructed and transmitted, which implies a reassessment of existing conceptual frameworks and pedagogical practices to adapt to new digital realities (Buckingham, 2007). Zorrilla (2023) opens the topic of transmedia assessment in universities.

González et al. (2023) and Avello et al. (2013) express that it is an essential tool for critical and active participation in society, allowing individuals to evaluate and create informative content in a responsible and reasoned manner. The inclusion of diverse opinions and expert perspectives underscores the need for an education that encompasses both critical media analysis and the ability to produce content, reflecting the bidirectional nature of modern communication.

The controversy between media literacy and transmedia literacy focuses on how these skills should be approached and taught in the current educational and cultural context (Ciastellardi, 2015; Weedon and Knight, 2015). Traditional media literacy focuses on teaching critical media skills in formal settings, while transmedia literacy is geared toward informal learning (Gallo et al., 2013; Prieto et al., 2019) and participatory cultures (Gambarato and Dabagian, 2016; Sigiliano and Borges, 2019).

Digital literacy

Digital literacy focuses on the skills needed to use and understand digital technologies (Buckingham, 2007). In the context of media education, this literacy is not limited to the development of technical skills, but also includes the critical ability to evaluate and use information effectively (Avello et al., 2013). Digital literacy includes skills in the use of electronic devices, software, internet applications, and social networks (Nguyen et al., 2022).

According to Gutiérrez-Martín and Tyner (2012), the goal is to integrate a variety of texts and contexts into the curriculum, both for analysis and for the creation of media products, thus extending the concept of literacy beyond traditional literacy to include visual and digital languages (Avello et al., 2013).

Avello et al. (2013) establish that there are criteria on which "true" digital literacy is based, among which they mention:

- Instrumental skills with ICT: referring to the basic skills necessary to manage and use technologies effectively.
- Ability to search for, select, organize, use, apply, and evaluate information: this involves being able to find relevant information, evaluate it critically, and organize it in a useful way.
- Collaboration, cooperation, effective communication, and ability to share: emphasizing the importance of teamwork, clear communication, and sharing information and resources with others.
- Content creation and publication: the ability to produce and disseminate information, whether through text, images, videos, or other digital media.
- Critical thinking, creativity, innovation, and problem solving: emphasizes the need to analyze information critically, be creative, innovate, and solve problems effectively.
- Social and cultural understanding, digital citizenship: refers to the ability to understand the social and cultural contexts in which technology is used and to behave responsibly as a digital citizen.
- Security and identity: emphasizes the importance of protecting personal information and maintaining a secure identity in the digital environment.

These criteria seek to ensure that people not only know how to use ICT, but are also able to do so responsibly, critically, and effectively.

The debate between digital and transmedia literacy focuses on how these two forms of literacy integrate and challenge traditional educational practices (Hovious et al., 2020; Scolari et al., 2018). Digital literacy refers to the ability to use digital technologies effectively, while transmedia literacy involves the ability to interact with narratives that span multiple platforms and formats (Rodrigues and Bidarra, 2014).

Background

The concept of media and digital literacy has evolved significantly in recent decades, driven by rapid advances in technology and the digitization of information. Historically, literacy was limited to the ability to read and write printed texts, but the digital age has expanded this concept to include a variety of skills related to the critical and creative use of digital media and technologies.

The importance of the concept of literacy in the field of communication and education arises from the need to promote a more beneficial use of the media (Aguaged-Gómez, 2012), with the main objective being to educate citizens who can consume and participate in media practices in a critical and conscious manner.

One of the first steps toward this goal was the Grünwald Declaration issued by UNESCO in 1982, which encouraged governments to develop media education so that people could critically analyze the content they consume and participate in the creation of media messages (Pérez, 2007). This declaration gave rise to the concept of *media literacy*. This concept is defined as the ability to access, analyze, evaluate, and communicate messages in a variety of forms (Potter, 2010). Although this definition is widely accepted, there is a need to clarify certain aspects due to the diversity of terminology in the field of education and communication (Valdivia-Barrios et al., 2018).

One of the main challenges that authors such as Valdivia-Barrios et al. (2018) have noted is the translation of the term *literacy* into Spanish as alfabetización, since while *literacy* refers to the development and acquisition of various languages, the Spanish translation is often limited to reading and writing. The breadth of the concept of literacy has given rise to the emergence of various types of literacy, such as *new media literacy*, *digital literacy*, and *information literacy* (Catts & Lau, 2008). This proliferation of terms has generated a debate about the need to unify these areas of knowledge into broader concepts such as media and information literacy (MIL) proposed by UNESCO (2018). MIL seeks to integrate different types of literacy into a holistic approach that encompasses both the media and other information providers (Romero-Romero et al., 2024).

Another important proposal is that of media competence formulated by Carmona and Ibañez (2011) from the perspective of critical pedagogy in their concern for teacher training. Similarly, Ferrés and Piscitell (2012) seek to avoid the fragmentation of literacies and align themselves with the European Union's movement to promote cross-cutting and standardized competencies. However, the use of the term competency introduces a new layer of complexity to the debate (Martens, 2013). Authors such as Ferrés and Piscitell (2012); Martens (2013), and Potter (2010) establish in their writings that it is essential to understand the difference between literacy as a competency and literacy as literacy, since the competency-based approach seeks the acquisition of generic and standardized skills, while the literacy approach focuses on the acquisition of language through media practice in a specific sociocultural context.

In this context, media practices are better understood. It is crucial to consider that language and learning, with language, especially in its multimodal form, playing a fundamental role in the digital age (Valdivia-Barrios et al., 2018). Learning, on the other hand, should be understood as a social and situated phenomenon that takes place in communities of practice. In this regard, Gutiérrez and Tyner (2012) emphasize that the integration of digital media into the curriculum is essential to promote an education that prepares students for the challenges of the 21st century, given that the growth of digital media platforms and social networks has created an environment in which students not only consume information but also produce and share it. This active participation in the digital ecosystem requires media and digital literacy that promotes a critical understanding of the media and an ability to create responsible and ethical content.

These studies prior to 2017 are represented in Table 1.

Table 1. *Background of media literacy and its relationship to language.*

Topic	Subtopic	Author	Year	Title	Thematic summary
Media Literacy	Definitions and evolution of the concept	UNESCO	1982	Grünwald Declaration	Promotion of critical and participatory media education
	Expansion of the concept and related terms	Catts and Lau	2008	New media literacy	Inclusion of new skills in digital media
	Integration of literacies	UNESCO	2018	Media and Information Literacy	Unification of media and information skills
Media Competence	Critical pedagogy and Web 2.0 tools	Carmona and Ibañez	2011	Critical pedagogy and Web 2.0	Teacher training through critical pedagogy
	Perspective on cross-cutting skills	Ferrés and Piscitell	2012	Media Competence	Integrative approach to media skills
	Differentiation between competence and literacy	Martens	2013	Literacy as competence	Comparison between generic and specific skills
	Debate on competence vs. literacy	Potter	2010	Media literacy	Critical analysis and communicatio tion of messages
Language and learning	The role of multimodal language in the digital age	Valdivia-Barrios et al.	2018	Multimodal language in the digital age	The importance of language in digital communication
	Learning as a social phenomenon	Gutiérrez and Tyner	2012	Integration of digital media into the curriculum	Educational role of digital media

Source: own elaboration

As a result of the systematic review, it was observed that there is little existing literature in the area of research covered by this project. It is therefore a field in expansion.

However, it is possible to mention some relevant articles, such as Gomero et al. (2023), who highlight that the use of transmedia narratives in higher education has shown significant progress in university curricula. However, they also point out the need for greater training for teachers and the adaptation of technological infrastructure to maximize the benefits of this approach. The

qualitative research conducted by these authors reveals that, although challenges exist, the opportunities for improving learning outcomes are promising.

Ślęzak-Świat (2022) found that university students use translanguaging and transmedia practices when taking notes, although not always effectively or strategically when interacting with digital texts. For example, although many students took notes in a combination of their native language (L1) and English (L2), most printed the text to read it, and only 7.5% took notes directly on the printouts. Furthermore, although they had access to note-taking applications that could be synchronized with shared documents on Google, none of the students used them. The author points out that, although students use translanguaging and transmedia practices when reading and taking notes, they could benefit from more explicit instruction on these strategies to improve their media and digital literacy. He argues that clear teaching of note-taking strategies in digital contexts would help students interact more effectively with information from diverse sources and develop a deeper understanding of texts.

For their part, Mora and Castaño (2018) proposed developing hypermedia literacy, digital culture, and transmedia practices in university students studying Basic and Intercultural Bilingual Education. The main objective was to improve the skills of future teachers to produce quality educational content using transmedia strategies. To achieve this purpose, a methodology based on active pedagogy and the flipped classroom was implemented, where students acquire theoretical knowledge through videos and then apply this knowledge in the creation of educational content, such as educational videos, games, and other forms of digital narratives (Rovira Collado, 2017). This approach is based on media convergence and educommunication, recognizing the relevance of Information and Communication Technologies (ICT) in contemporary education. This study is expanded upon in other subsequent field studies (Perry, 2020; Peña-Acuña and Sánchez-Verdejo, 2023; Toscano Fuentes and Sánchez Gago, 2024).

This research by Grijalba and Lara (2019) focuses on assessing the levels of media literacy among university students in the creation and management of digital content. The study was conducted at a Mexican university (UAdeO) and used a simple probability sample of 346 students, distributed by areas of knowledge. Nonparametric tests (Chi-Square) were applied to detect statistical differences according to the students' area of knowledge, thus revealing variations in media literacy levels between groups.

The study by Alves and Lacerda (2024) explores how transmedia storytelling can be applied to Portuguese language learning in an educational context. The authors highlight that transmedia narratives, by requiring students to interact with different media and languages, can foster the development of essential skills for media and digital literacy, such as the ability to analyze information, identify intertextual references, understand different languages (verbal, visual, audio), and produce content in various digital formats.

Andrade-Velasquez and Fonseca-Mora (2021) explored the potential of transmedia narratives (TN) as an innovative tool for foreign language teaching. The authors conducted a systematic review of studies published between 2010 and 2020 to understand how TN has been applied in language teaching and the benefits observed. They found that TN can improve student motivation, encourage reading for pleasure, and develop communication skills. The article concludes that TN represents a promising strategy for foreign language teaching, although more research is needed to fully understand its impact.

Androutsopoulos' (2021) focus on the integration of digital practices in language education advocates for a pedagogy that combines digital practices and critical awareness. This includes

incorporating students' extracurricular digital experiences, analyzing standard linguistic ideologies, and promoting understanding of the complexities of online interaction.

Sultana and Dovchin (2021), in their research article, explore how university students of English as a foreign language (EFL) in Bangladesh and Mongolia use digital language outside the classroom. Based on Facebook data, the study reveals that these students relocalize linguistic and cultural resources, creating new meanings relevant to their local contexts. They argue that these digital practices demonstrate a socio-critical awareness among students, who challenge social, cultural, political, and racial inequalities through language. The authors conclude by suggesting that these digital practices have implications for foreign language teaching, advocating for a pedagogical approach that values students' linguistic creativity and critical awareness.

Tai and Zuo (2024) presented a research article exploring how an English as a Second Language (ESL) teacher uses translanguaging, the fluid combination of multiple linguistic and multimodal resources, to teach English online. Over ten weeks, the study analyzes how the teacher improved his translanguage competence by integrating his native language, Chinese, along with English, gestures, visual elements, real-life examples, and technological tools such as color highlighting in Word. The findings reveal that the teacher's ability to create a virtual translanguage space was influenced by a professional development workshop and his willingness to adopt innovative pedagogical approaches. Ultimately, the study argues that translanguage is fundamental to interactive c e competence in the electronic classroom (e-CIC), and that teachers must leverage a variety of resources to teach English effectively in virtual environments.

Montoya (2024) addresses the importance of transmedia practices in university language education as a crucial component in fostering media and digital literacy. Highlighting the potential of transmedia narratives to transform foreign language teaching and learning, especially in a context where the media ecosystem is constantly evolving.

Some examples of transmedia projects in university language education mentioned by Montoya include the creation of transmedia narratives by students using different platforms and media, the genuine integration of technology to develop innovative teaching proposals, and projects where students are producers under the guidance of the teacher as a learning facilitator.

The author also argues that it is crucial for these transmedia practices to be implemented from a solid pedagogical perspective, not just using technology for its own sake, but understanding what, why, and for whom it is being taught, considering the context and specific transmedia skills of the students, and establishing assessment criteria that promote cooperation, teamwork, and exploration of various platforms.

Montoya (2024) discusses the assessment of these transmedia practices, a concept that goes beyond the simple measurement of knowledge: a mediating assessment that seeks to understand, reflect on, and reconstruct students' learning, for which he proposes some key aspects of transmedia assessment, such as evaluating performance and use of the foreign language in real situations, assessing creativity, interaction, and transmediality of projects, and establishing assessment criteria agreed upon with the students.

In addition, the significant potential of tools such as ChatGPT and artificial intelligence (AI) for education is mentioned, especially in media literacy and digital innovation. However, the need for teachers and researchers to collaborate to integrate these AI tools safely and constructively into the classroom and to familiarize university students with the responsible and ethical use of AI is emphasized.

Herrero (2021) focuses on the integration of language and culture in the teaching of Spanish as a foreign language (ELE) through transmedia strategies. The study analyzes the crisis in foreign language teaching in the United Kingdom, particularly the decline in students of Spanish as a foreign language (ELE). The main objective is to propose transmedia education as an innovative strategy for integrating language and culture teaching, thereby motivating students. The author first examines the current educational context in the United Kingdom, including the influence of Brexit and the predominant pedagogical model that emphasizes grammar and vocabulary over cultural content. Next, research projects from Manchester Metropolitan University are presented that explore the integration of transmedia storytelling in the teaching of ELE, highlighting the potential of this methodology to develop linguistic, intercultural, and digital skills in students. In a subsequent study, this researcher continues to delve into transmedia practices in terms of the use of open resources (2022).

A similar study is carried out by Miralles and Zaragoza (2017), in which they describe an educational innovation project at the University of Valencia, where a learning experience based on transmedia narrative was implemented for the subject of *Catalan Literature of the Modern Age*. The main objective was to motivate students and deepen their knowledge of the Catalan Baroque, a period traditionally considered complex and unattractive.

In this initiative, students were organized into groups and guided by the teacher to create digital content, such as Facebook pages, Instagram profiles, blogs, and videos. Through creativity and collaborative work, the aim was to disseminate the literature of the period in an attractive and accessible way. The evaluation of the project showed positive results in terms of student participation, understanding of the content, and revitalization of the educational environment. These encouraging results motivate the authors to consider expanding this educational experience to other universities, highlighting the potential of transmedia storytelling to revitalize the learning of literature and make it more relevant to contemporary students.

Grasso and Martino (2019) presented what the authors consider to be an approach that goes beyond the traditional classroom by turning students into "prosumers" of content, promoting more meaningful and collaborative learning. They explored the use of transmedia storytelling in teaching English phonetics, specifically in the production of the /r/ sound, targeting teacher training students and translators at the National University of La Plata. The project introduces an innovative methodology that uses various digital platforms such as YouTube, Instagram, Twitter, Google Docs, and Padlet to present content interactively and encourage active student participation. The project seeks to leverage digital tools to improve the understanding and practice of English phonetics, providing students with an enriched educational experience adapted to contemporary technologies.

Table 2. *Results of the systematic review*

Topic	Authors	Year	Title	Subject summary	Field of language education	Visual Format	Type of Research and Sample Size
nd Transmedia Practices	Gomero et al.	2023	Transmedia in higher education.	Advances in transmedia storytelling in the university environment.	Knowledge of language	Yes	Qualitative Sample: 21
	Ślęzak-Świat	2022	Use of translanguage and transmedia practices in note-taking	Translanguaging approach, transmedia in writing	Reading and writing	Yes	Systematic observation. Sample: 45
	Tai and Zuo	2024	Translanguaging in online English language teaching	Translanguaging, online teaching of English as an additional language	Orality and literacy	Yes	Case study (qualitative) Sample: 60
Literacy and Digital Culture	Grijalba and Lara	2019	Media skills among university students	Levels of media and digital literacy	Language knowledge	No	Statistical Sample: 346
	Mora and Castaño	2018	Hypermedia literacy in future teachers	Hypermedia literacy, digital culture, transmedia	Reading and writing	Yes	Experimental Sample: 200
	Montoya	2024	Transmedia practices in university language education	Transmedia practices, media literacy, digital literacy	Language knowledge	Yes	Theoretical
Transmedia Narratives in Education	Alves and Lacerda	2024	Transmedia Narrative in Portuguese Language Learning	Transmedia narrative, literacy, digital literacy, Portuguese	Literacy	Yes	Experimental Sample: 50
	Andrade-Velasquez and Fonseca-Mora	2021	The potential of transmedia narratives in foreign language teaching	Transmedia narratives, motivation, communication skills	Orality and literacy	Yes	Systematic review. Sample: 40
	Grasso and Martino	2019	Use of transmedia narrative in teaching English phonetics	Transmedia narrative, English phonetics, prosumers	Orality	Yes	Experimental: Sample: 35
	Miralles and Zaragoza	2017	Transmedia narrative in the teaching of Catalan literature	Transmedia narrative, Catalan literature, innovation	Literary education	Yes	Case study (qualitative) Sample: 25
	Perry	2020	Multimodal Engagement through a Transmedia Storytelling Project for Undergraduate Students	Multimodal engagement of university students through transmedia storytelling.	Language skills, reading and writing, and literary education	Yes	Case study (mixed) Sample: 75
	Peña-Acuña and Sánchez-Verdejo Pérez	2024	Mixed research on teachers in initial training participating in	Students' perceptions of educational digital	Literacy and literary education	Yes	Mixed technique. Sample: 75

			digital transmedia practices	production combining storytelling and short films			
	Rovira Collado	2017	Transmedia storytelling: Literature, digital media, and social networks	Integration of transmedia storytelling in different media and social networks	Literary education	Yes	Theoretical
	Toscano Fuentes and Sánchez Gago	2024	Development of multiliteracy in English as a foreign language through a gamified project: Stranger disappearance	Transmedia gamification improves literacy and motivation	Language knowledge, reading and writing, and literary education	Yes	Qualitative. Sample: 120
Integration of Digital Practices and Critical Pedagogy	Androutsopoulos	2020	Integration of digital practices in language education	Digital practices, critical pedagogy, linguistic ideologies	Language knowledge	No	Theoretical
	Sultana and Dovchin	2021	Use of digital language by EFL students	Digital language, sociocriticism, EFL	Literacy	No	Participant observation. Sample: 50
Integration of Language and Culture in ELE	Herrero	2021	Integration of language and culture in teaching Spanish as a foreign language	Integration of language and culture in teaching Spanish as a foreign language.	Language knowledge and literary education	No	Case study (qualitative). Sample: 30

Source: own elaboration

Considerations of the results

Research on the effectiveness of transmedia practices in university language education is still ongoing. While there is evidence that these practices can be beneficial, more research is needed to assess their long-term impact on language learning and media and digital literacy. Nevertheless, in this section, some salient aspects can be elucidated in accordance with the results obtained and the theory underlying the research, among which the following can be mentioned.

Regarding the importance of transmedia practices for media and digital literacy, it can be observed that both the results and the theoretical basis agree on the relevance of transmedia practices for developing media and digital literacy in university students (Avello et al., 2013; Montoya, 2024; Rué, 2004; Tyner et al., 2015). Both highlight its potential to improve teaching (Gutiérrez and Tyner, 2012; Mora and Castaño, 2018) and language learning, especially in a context of media convergence (Herrero, 2021). However, some studies suggest that the implementation of these practices may present challenges for digital novices and requires further research (Dickinson-Delaporte et al., 2020), suggesting that the acquisition of transmedia skills varies significantly among adolescents, indicating the need for further investigation to understand these differences (Masanet et al., 2019).

Another aspect that stands out is the need for solid pedagogical integration for the application of transmedia practices, given that several authors agree that reflective and critical pedagogical

integration is required, considering the context, the needs of students, and the learning objectives (Avello et al., 2013; González et al., 2023; Montoya, 2024).

Studies such as those by Herrero (2022) and Mora and Castaño (2018) reflect efforts to develop digital and transmedia skills in future teachers. There has also been an effort to apply these interventions to language teaching, including the creation of blogs and podcasts, the design of games and simulations, and the use of social networks (Edmond, 2014). However, it is not specified whether these interventions were scientifically evaluated or the type of evaluation used (quantitative, qualitative, or mixed).

A notable and emerging contribution in the field of transmedia education is presented by Montoya (2024), who emphasizes the need to develop assessment methods that capture the holistic and intercultural learning promoted by these practices. This approach seeks to transcend traditional assessments, providing a more comprehensive view of the educational process.

In addition, the use of translanguaging in technology-mediated language teaching is highlighted. A significant example is the study by Tai and Zuo (2024), which examines how an English as a Second Language teacher implements translanguaging in a virtual environment, thus facilitating understanding and learning in multilingual and digitally mediated contexts.

In the era of digitalization and artificial intelligence, Montoya's (2024) work on the integration of tools such as ChatGPT in education highlights the need to develop digital and media literacy. Montoya emphasizes the importance of responsible and ethical use of these technologies, underscoring their potential to enrich the educational process if handled properly.

In an earlier stage, general and theoretical research was conducted from a linguistic education perspective on media literacy, media competence, language, and learning. However, from 2017 to 2024, a more specialized topic has been identified with scientifically evaluated interventions. These include translanguage and transmedia, digital literacy and culture, transmedia storytelling in education, and the integration of language and culture in ELE.

In this vein, we find that there are emerging areas of research in language education, as shown in Table 3 below. Various studies have explored and delved deeper into the theory of how transmedia narratives are used to teach different languages. Andrade-Velásquez and Fonseca-Mora (2021) and Herrero (2021) investigate its potential in foreign language teaching. Montoya (2024) reflects on its application at the higher level from a meta-teaching perspective. These studies demonstrate the potential of transmedia narratives to enrich language learning through innovative and contextually relevant approaches.

There are applied studies that delve into the impact on language learning that show programming with active teaching methodologies. These are interventions with combined transmedia programming. Through evaluated intervention, Peña-Acuña and Sánchez-Verdejo delve into the positive perception of ethical values and creativity by combining stories with short films in a PBL intervention and elements of *Education Maker* in teachers training in additional languages. Toscano Fuentes and Sánchez Gago (2024) combine transmedia teaching intervention with the gamification method with good learning outcomes. There are studies on translanguage and transmedia (Gomero et al., 2022). Finally, the research highlights the importance of a reflective and critical integration of transmedia practices in education. These assertions answer the first research question.

Table 3. *Emerging themes found in the research*

Emerging Theme	Authors	Year	Title	Thematic Summary
Transmedia narratives in language education	Andrade-Velasquez and Fonseca-Mora	2021	Transmedia narratives in foreign language learning	Systematic review of the use of transmedia narratives in foreign language teaching
	Herrero	2021	Integration of language and culture in the teaching of Spanish as a foreign language	Integration of language and culture in the teaching of Spanish as a foreign language.
Transmedia Narratives in Higher Education	Montoya	2019	Transmedia Narratives: a case study of an innovative seminar at UNSAM	Reflection on transmedia narratives and their implementation in higher education
Translanguage and Transmedia Practices	Gomero et al.	2023	Transmedia in higher education.	Advances in transmedia storytelling in the university setting
Transmedia programming with active methodologies	Peña-Acuña and Sánchez Verdejo;	2024	Mixed research on teachers in initial training participating in digital transmedia practices	Students' perceptions of educational digital production combining storytelling and short films
	Toscano Fuentes and Sánchez Gago	2024	Development of multiliteracy in English as a foreign language through a gamified project: Stranger disappearance	Transmedia gamification improves literacy and motivation

Source: own elaboration

Conclusion

The studies found to focus primarily on language knowledge, reading and writing, and literary education. Orality receives less attention. Even so, more research is needed in these areas of language education, especially with regard to orality and with statistical or mixed-method approaches in contexts of transmedia practices and digital literacy at university. These conclusions answer the second research question.

Of the 17 studies found, 13 used visual formats. This means that this occurs in interventions in a total of 76.4% of the sample. This indicates that transmedia practice is aligned with the promotion of visual culture at the university level. This assertion answers the third research question.

Regarding the type of scientific research carried out in the interventions, of the 17 studies identified, qualitative research predominates (35.3%), followed by quantitative (29.4%), theoretical (17.6%), mixed (11.8%), and systematic review (5.9%). It is recommended to continue qualitative studies that allow for a deeper understanding of the impact of language learning, as well as to increase quantitative studies with larger samples. Likewise, it is recommended to conduct mixed studies to obtain a more complete and robust view of educational research. These data answer the fourth research question.

As a practical application, it is essential that teachers understand the pedagogical purpose behind the use of technology and consider the context and specific skills of their students. This would ensure that technology is not an end in itself, but an effective tool for achieving clear and meaningful educational goals.

There are also gaps that require attention. For example, further studies are needed to investigate the affective and cognitive impact on language education or to assess the long-term impact of transmedia practices on the learning of additional languages. Furthermore, although some studies focus on training future teachers in the use of these practices, greater emphasis is needed from educational and university policies to promote this training in a systematic and extensive manner.

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ISBN: 978-9942-53-127-8



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