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REGULATORY FRAMEWORK AND INSTITUTIONAL MANAGEMENT FOR ADOPTING LARGE LANGUAGE MODELS IN HIGHER EDUCATION

Marco regulatorio y gestión institucional para la adopción de grandes modelos lingüísticos en la educación superior

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1. Iván Miguel García López. Doctor en Administración. Universidad La Salle. ivan-garcia@lasallistas.org.mx
ORCID ID: https://orcid.org/0009-0003-2820-6350

2. Jessica Nájera Ochoa*. Doctora en Administración y Sustentabilidad. Universidad La Salle. jnajerao@yahoo.com.mx
ORCID: https://orcid.org/0009-0009-0241-7460 *autor de correspondencia

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Resumen

La adopción de Modelos de Lenguaje de Gran Tamaño (LLM) en la educación superior ofrece oportunidades de innovación, planteando desafíos con la gobernanza, regulación y rendición de cuentas institucional. Las universidades deben equilibrar la experimentación ética, integridad académica y cumplimiento normativo; sin embargo, carecen de marcos consolidados para su adopción responsable. Este estudio examina cómo estas instituciones están respondiendo, mediante análisis de los enfoques regulatorios y de gobernanza para integrar los LLM, combinando la Revisión Sistemática de la Literatura (SLR) con un estudio de caso cualitativo de la educación superior mexicana. Se sintetiza la evidencia sobre marcos regulatorios, modelos de gobernanza, estrategias de liderazgo y mecanismos de cambio organizacional para adoptar inteligencia artificial generativa en las universidades. Se encontró cómo las políticas institucionales y las prácticas administrativas surgen en condiciones de incertidumbre regulatoria. A pesar del interés institucional en los LLM, las respuestas de gobernanza continúan fragmentadas, con tensiones entre innovación y regulación, en lo que respecta a integridad académica, ética y capacidad de implementación.

Palabras clave: *Modelos lingüísticos de gran tamaño; Gestión de la innovación; Educación superior; Gobernanza institucional; Política educativa.*

Abstract

The adoption of Large Language Models (LLM) in higher education offers opportunities for innovation, but also poses challenges with governance, regulation, and institutional accountability. Universities must balance ethical experimentation, academic integrity, and regulatory compliance; however, they lack consolidated frameworks for their responsible adoption. This study examines how these institutions are responding, through an analysis of regulatory and governance approaches to integrating LLMs, combining Systematic Literature Review (SLR) with a qualitative case study of Mexican higher education. This paper synthesizes evidence on regulatory frameworks, governance models, leadership strategies, and organizational change mechanisms for adopting generative artificial intelligence in universities. It finds how institutional policies and administrative practices emerge under conditions of regulatory uncertainty. Despite institutional interest in LLMs, governance responses remain fragmented, with tensions between innovation and regulation, regarding academic integrity, ethics, and implementation capacity.

Keywords: *Large language models; Innovation management; Higher education; Institutional governance; Educational policy.*

JEL Clasification: I23, I28, O33, D73, L86, O38.

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1. Introduction

The rapid development and deployment of Large Language Models (LLMs) in higher education have accelerated shifts in teaching, learning, and institutional management, while simultaneously raising urgent governance and regulatory concerns. Universities are increasingly expected to implement policies that balance innovation, ethical use, and accountability. This expectation places institutional leadership at the center of decision-making processes related to emerging educational technologies. Yet, many institutions lack clear regulatory frameworks to address risks such as academic integrity, privacy, transparency, and organizational responsibility. Consequently, understanding how institutions respond to these pressures has become a growing focus of recent scholarly research.

Recent studies demonstrate a growing academic interest in understanding the implications of LLMs for governance and regulation in higher education. Peláez-Sánchez et al. (2024) examined publications from 2018 to 2023, linking LLM adoption with Education 4.0 principles while emphasizing pedagogical and regulatory challenges. Oncioiu & Bularca (2025) explored artificial intelligence governance in higher education, stressing the role of knowledge-based strategies in fostering legal awareness and institutional ethical literacy. In a complementary line of research, Mahrishi et al. (2025) analyzed global regulatory initiatives, identifying emerging ethical standards, institutional policies, and governance mechanisms already being piloted in universities worldwide. Taken together, this body of work suggests that while scholarly interest and pilot practices are expanding, administrative and regulatory dimensions remain insufficiently developed.

This article addresses these gaps through two complementary contributions. First, it presents a Systematic Literature Review (SLR) focused on regulatory frameworks and institutional governance models for the adoption of LLMs in higher education, emphasizing the dimensions of administration, leadership, organizational change, and internal policy. This focus prioritizes institutional governance, administrative structures, and internal policy design over purely technical or pedagogical perspectives. Second, it complements this review with a case study from Mexico, illustrating how a university navigates the administrative challenges of adopting LLM-based tools, including policy development, identification of institutional barriers, and adaptation of governance strategies. By combining a global synthesis with a local case study, this article provides conceptual and practical insights for institutional leaders and policymakers seeking to balance innovation, ethical responsibility, and organizational effectiveness in higher education.

2. Literature review

Research on Artificial Intelligence (AI) adoption in higher education has expanded markedly over the last five years, reflecting both rapid technological development and growing institutional concerns. LLMs have been identified as transformative tools with the potential to enhance teaching, learning, and research processes, while simultaneously creating risks that require robust governance. These risks extend beyond pedagogical practice to include institutional accountability, regulatory

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compliance, and organizational responsibility. For Bozkurt et al. (2021), digital transformation of education requires not only technological readiness but also institutional frameworks that ensure ethical, inclusive, and sustainable adoption. This insight aligns with broader findings emphasizing the intersection of innovation, regulation, and institutional capacity in higher education.

Several systematic reviews emphasize that AI adoption in higher education remains uneven across regions and institutions, with significant gaps in regulatory preparedness, particularly with respect to governance structures and accountability mechanisms. Zawacki-Richter et al. (2023) identify global trends in open, distance, and digital education, noting that while AI tools are increasingly integrated, many universities lack coherent strategies for governance and accountability. From a governance perspective, Kohnke et al. (2023) stress the importance of aligning AI adoption with institutional policies that safeguard academic integrity and data security. These studies suggest that governance and policy are not peripheral issues but central to the sustainable implementation of LLMs. This centrality becomes particularly visible when AI adoption is examined from a management and leadership perspective.

From an institutional management perspective, AI adoption introduces significant challenges related to organizational change and innovation leadership. Cheng & Wu (2024) highlight that universities often struggle with balancing innovation with accountability, particularly when faced with disruptive technologies. This tension is amplified in the case of generative AI, given its rapid diffusion and ambiguous regulatory status. More recently, Aggarwal, (2023) underscores that generative AI adoption must be accompanied by clear policies, capacity building, and leadership strategies to avoid exacerbating inequalities in access and outcomes. Together, these insights reinforce the argument that institutional governance and regulatory frameworks mediate how LLMs shape higher education outcomes.

Overall, the literature demonstrates that while enthusiasm for LLMs is growing, administrative, ethical, and regulatory structures remain underdeveloped. This imbalance contributes to fragmented institutional responses and inconsistent implementation across universities. This reinforces the need for research that not only maps current practices but also informs actionable governance frameworks for policymakers and institutional leaders.

2.1 Theoretical background

The integration of LLMs in higher education can be understood through organizational and management theories that explain how institutions respond to technological disruption. In this sense, regulatory expectations, professional norms, and reputational concerns shape institutional responses to LLM adoption (Brajovic et al., 2023). From this perspective, LLM adoption is not only a technological issue but also a process shaped by institutional legitimacy, governance norms, and compliance requirements.

Change management theories are equally relevant, as the introduction of generative AI tools challenges established workflows, roles, and pedagogical practices. These challenges affect both academic and administrative dimensions of higher education institutions. Kotter's model of organizational change, emphasizing the creation of urgency, coalition-building, and embedding innovation into culture, has been frequently applied in educational contexts (Adel et al., 2024). In the case of LLMs, successful adoption requires aligning leadership vision with faculty development, student engagement,

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and regulatory adaptation. This alignment highlights the strategic role of institutional leadership in governing AI-driven innovation.

The concept of strategic management in higher education emphasizes the role of leadership and governance in adressing innovation responsibly. Such strategies link technological adoption to institutional mission, values, and accountability mechanisms (Chan & Zhou, 2023). This requires balancing short-term experimentation with long-term sustainability, particularly in contexts where regulatory frameworks remain underdeveloped.

Finally, ethics of AI in education offers a complementary framework that foregrounds issues of fairness, transparency, and academic integrity. These ethical principles have direct implications for institutional governance and policy design. Brajovic et al. (2023) argues that trustworthy AI should be guided by principles of beneficence, non-maleficence, autonomy, and justice, principles that universities must translate into policies and governance structures. This theoretical grounding informs the methodological design and analytical framework adopted in this study.

3. Methods

3.1 Research method

This study employed a Systematic Literature Review (SLR) combined with a qualitative case study. The SLR synthesized evidence regarding regulatory frameworks and institutional governance for the adoption of LLMs in higher education, while the case study provided contextualized insights from a Mexican university.

3.2 Research design

The review followed the PRISMA 2020 guidelines to ensure transparency and replicability (Page et al., 2021). The methodological approach was informed by established standards for evidence synthesis in information systems and educational research (Kitchenham & Charters, 2007). The case study design followed Baber et al. (1995) principles for explanatory single-case studies, emphasizing institutional processes, policies, and challenges related to LLM adoption.

3.3 Data collection tools

The literature search was conducted in Scopus, Web of Science, ERIC, SpringerLink, and ACM Digital Library. Keywords were grouped into three categories: (1) technology ("large language models," "generative AI," "ChatGPT"); (2) educational context ("higher education," "university," "college"); and (3) governance dimensions ("policy," "regulation," "administration," "governance"). Boolean operators were adapted to each database. For example, in Scopus and Web of Science the string was:

("large language model*" **OR** "generative AI" **OR** "ChatGPT") **AND** ("higher education" **OR** univer-sit* **OR** college) **AND** (policy **OR** governance **OR** regulation **OR** administration)

Equivalent expressions were applied in ERIC, SpringerLink, and ACM Digital Library. Searches were limited to peer-reviewed works published between January 2020 and June 2024 in English or Spanish.

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3.4 Sampling or research group

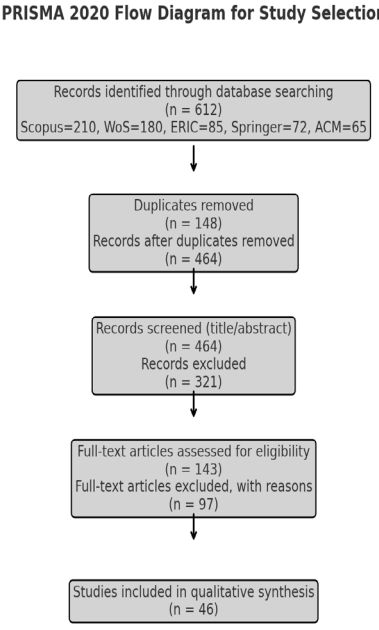
Studies were included if they: (1) addressed higher education contexts; (2) discussed governance, regulation, or administration of AI/LLMs; and (3) were peer-reviewed. Exclusion criteria eliminated non-peer-reviewed materials, purely technical papers without a governance focus, and studies outside the 2020-2024 window.

The case study examined one public Mexican university, focusing on administrators involved in digital transformation initiatives. Data sources included institutional documents, policy drafts, and semi-structured interviews with eight administrators responsible for governance and policy design.

Research procedures

The database search retrieved a total of 612 records (Scopus = 210; Web of Science = 180; ERIC = 85; SpringerLink = 72; ACM Digital Library = 65). After removing 148 duplicates, 464 records remained for title and abstract screening. In this stage, 321 records were excluded as irrelevant to the research focus. The full text of 143 articles was assessed for eligibility, of which 97 were excluded for lacking focus on governance, regulation, or administration. The final synthesis included 46 studies, which were coded and analyzed thematically. The case study data were analyzed using thematic coding in NVivo, triangulating interview transcripts with institutional documents to identify categories related to governance, regulation, and organizational change. The overall process is illustrated in Figure 1 (PRISMA 2020 flow diagram), which summarizes the identification, screening, eligibility, and inclusion stages of the review.

Figure 1. PRISMA 2020 flow diagram for study selection.



Source: Own elaboration based in Page et al. (2021).

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3.6 Research questions

Two research questions guided the SLR:

- RQ1: What regulatory frameworks and institutional governance models have been proposed or implemented for the adoption of Large Language Models in higher education between 2020 and 2024?
- RQ2: What gaps and challenges are identified in the literature regarding administrative, ethical, and organizational aspects of LLM integration in higher education?

These questions structured the coding and synthesis of the included studies and guided the integration with the Mexican case study findings.

3.7 Validity and reliability measures

To enhance validity, the SLR applied triangulation across databases, double screening with inter-rater reliability (Cohen's $\kappa > 0.80$), and adherence to PRISMA reporting standards (Page et al., 2021). For the case study, member checking was used with participants to confirm accuracy, and document triangulation validated consistency between reported practices and policy drafts. Reliability was strengthened by maintaining a transparent audit trail of coding decisions and data analysis.

4. Findings and discussion

4.1 Findings from the systematic literature review

The SLR identified four dominant and interrelated themes regarding the governance and regulation of LLMs in higher education: (1) policy and regulatory frameworks, (2) institutional governance and leadership, (3) ethical and academic integrity concerns, and (4) organizational change and innovation management.

First, studies consistently emphasized the absence of comprehensive regulatory frameworks guiding AI adoption in higher education. Most institutional responses remain reactive, relying on interim or fragmented policies rather than consolidated governance architectures. Chang et al. (2023) noted that while universities are experimenting with AI applications, most operate in regulatory vacuums, relying on ad hoc policies rather than systematic governance structures. At the international level, Holmes et al. (2023) highlighted that international initiatives remain fragmented, with limited mechanisms to ensure cross-border consistency in academic integrity and ethical use. Together, these findings indicate a persistent regulatory vacuum that limits consistency, accountability, and institutional coordination.

Second, institutional governance structures and leadership capacity emerged as critical mediators of LLM adoption. Antonopoulou et al. (2023) argued that universities must embed AI adoption within broader digital transformation strategies, yet many institutions lack the leadership preparedness to navigate these shifts. Without such alignment, AI initiatives tend to remain isolated and inconsistently implemented. Kohnke et al. (2023) further observed that faculty perceptions of AI adoption depend heavily on how institutional policies communicate expectations, support professional development, and align with teaching missions.

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Third, concerns about academic integrity and ethics dominated the literature. These concerns are consistently framed as institutional, rather than purely pedagogical, challenges. Demchenko et al. (2021) stressed that generative AI poses risks of plagiarism, bias, and opacity in assessment, requiring universities to craft policies that safeguard fairness and transparency. Floridi (2023) extended this by framing AI ethics around trustworthiness and justice, principles that are still inconsistently applied in higher education contexts. However, the literature suggests that these ethical principles are unevenly translated into enforceable institutional policies.

Finally, at the topic of organizational change and innovation management, they both highlighted opportunities and structural barriers to LLM integration. Kohnke et al. (2023) described how disruptive technologies often clash with bureaucratic structures, delaying effective integration. These tensions often delay policy consolidation and weaken institutional coherence. More recently, Abhishek et al. (2025) pointed out that universities must balance the drive for innovation with institutional accountability, ensuring that AI adoption aligns with equity, inclusion, and sustainability goals.

This fragmentation highlights the value of examining context-specific institutional responses, such as those observed in the Mexican higher education system. These findings underscore the need for case-based insights to complement global perspectives and illustrate how universities in specific contexts, such as Mexico, are responding to these challenges.

4.2 Findings from the case study in Mexico

The Mexican case illustrates a transition from informal guidance toward increasingly formalized institutional governance mechanisms for the regulation of generative artificial intelligence and LLMs in higher education. Across major public and private universities, policies addressing ethical use, academic integrity, and responsible adoption of generative AI are emerging, although their maturity and enforceability remain uneven (Hunton, 2025). This pattern reflects broader regional dynamics in Latin America, where institutional experimentation often precedes the consolidation of binding regulatory frameworks (Ruvalcaba-Gomez & Garcia-Benitez, 2025). As a result, Mexican universities offer a relevant case for examining early-stage governance responses under conditions of regulatory uncertainty.

At the institutional level, several universities have developed explicit policy instruments to guide the use of generative AI in teaching and assessment. Tecnológico de Monterrey has issued formal guidelines for both faculty and students that articulate expectations regarding ethical use, disclosure of AI assistance, and academic integrity, positioning these documents within existing integrity and quality assurance structures (Tecnológico de Monterrey, 2024a; Tecnológico de Monterrey, 2024b). Similarly, the Universidad de Guadalajara has adopted university-level agreements complemented by guidance from UDGVirtual, framing generative AI as a pedagogical resource subject to ethical principles and institutional oversight (Universidad de Guadalajara, 2023; Universidad de Guadalajara, 2024). At Universidad Nacional Autónoma de México (2024), institutional initiatives provide recommendations and curated resources aimed at fostering responsible classroom use, although these remain advisory rather than mandatory. Together, these cases demonstrate an emerging commitment to governance, while also revealing differences in scope, formality, and enforcement mechanisms.

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Evidence from interviews conducted for this study confirms that, despite the proliferation of policy documents, implementation remains a significant challenge. Administrators reported variability in faculty awareness, resistance linked to workload and assessment redesign, and limited institutional capacity for monitoring compliance. These findings align with empirical research showing that faculty members across Mexican and Latin American universities perceive uncertainty regarding acceptable uses of generative AI and express a need for clearer protocols and training (Baque et al., 2024). Consequently, governance effectiveness depends not only on policy articulation but also on organizational support structures that translate norms into practice.

Capacity building and organizational change emerged as critical enabling conditions for effective governance. Institutional materials emphasize training initiatives, disclosure practices, and formative approaches to assessment as mechanisms to mitigate risks associated with generative AI (Tecnológico de Monterrey, 2024a; Tecnológico de Monterrey, 2024b; Universidad de Guadalajara, 2023; Universidad Nacional Autónoma de México, 2024).

These strategies resonate with international evidence indicating that professional development and ethical literacy are central to sustainable AI adoption in higher education (Abunaser et al., 2025). Overall, the Mexican case suggests that while governance frameworks are emerging, their consolidation requires sustained investment in institutional capacity, leadership coordination, and alignment with broader regulatory regimes.

5. Integrated discussion

Integrating findings from the SLR with evidence from the Mexican case reveals convergent patterns in how universities respond to the governance challenges posed by generative artificial intelligence and LLMs. Across contexts, institutions tend to progress through similar stages of adoption, beginning with awareness and informal guidance, followed by the development of interim policies, and eventually moving toward formal governance instruments (Kohnke et al., 2023). However, differences persist in policy scope, enforcement mechanisms, and stakeholder communication, reflecting variations in institutional capacity and regulatory environments.

Global reviews consistently report that many institutional policies remain fragmented and overly focused on academic integrity in assessment, often neglecting broader issues such as accountability structures, equity, and data protection. The Mexican case both confirms and nuances this observation (Hunton, 2025; Ruvalcaba-Gomez & Garcia-Benitez, 2025). Universities such as Tecnológico de Monterrey and Universidad de Guadalajara have begun to formalize governance through public-facing guidelines and institutional agreements, yet interviews indicate that translating these documents into everyday academic practice requires stronger leadership, clearer role definitions, and systematic monitoring mechanisms.

A key insight emerging from this integration is the need for a dual-track governance approach. On one hand, universities must codify baseline policies that clearly define permitted uses of generative AI, disclosure requirements, academic integrity standards, and privacy safeguards. On the other hand, these policies must be supported by capacity-building systems (Kohnke et al., 2023), including faculty development programs, redesigned assessment practices, and operational workflows embedded within academic integrity and quality assurance units (Antonopoulou et al., 2023). Without this organizational

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infrastructure, policies risk remaining symbolic rather than functional.

In the Mexican context, existing guidelines and agreements provide an important scaffold for responsible AI governance, but further consolidation is required to close the gap between formal regulation and institutional practice. Embedding audit trails, course-level disclosure templates, and formative assessment alternatives aligned with integrity principles and national data-protection norms represents a critical next step (Adel et al., 2024; Peláez-Sánchez et al., 2024). This integrated perspective reinforces the broader conclusion of the study: effective governance of generative AI in higher education depends not solely on regulatory texts, but on sustained organizational change that aligns innovation with accountability (Oncioiu & Bularca, 2025). This integrated approach closes the gap between written policies and actual governance practices that the case study and literature simultaneously highlight. Table 1 summarizes some of Mexican institutional policies.

Table 1. Comparison of Mexican Institutional Policies and Global Criteria for GenAI Governance in Higher Education

Dimension	Tecnológico de Monterrey (2024)	Universidad de Guadalajara (2023-2024)	Universidad Nacional Autónoma de México (2024)	Global reviews (Cheng & Wu, 2024; Zawacki-Richter et al., 2023)
Policy scope	Formal faculty & student guidelines; focus on ethical use, disclosure, integrity.	Council agreements + UDGVirtual guide; broad scope across teaching & learning.	Recommendations and curated resources; advisory rather than mandatory.	Most institutions have fragmented policies; many focus narrowly on plagiarism/originality.
Ethics & integrity	Explicit emphasis on academic honesty, responsible disclosure, fair use.	Addresses ethical concerns but remains general in enforcement mechanisms.	Highlights fairness, transparency, accountability; advisory tone.	Reviews find uneven emphasis on ethics; integrity guidelines often lack operational detail.
Data privacy & security	Mentions need to respect existing data laws; not deeply elaborated.	Limited reference to privacy; mostly pedagogical orientation.	General concern about safe use, no binding standards.	Identified as a global gap; very few institutions integrate robust data-protection clauses.
Faculty & student capacity	Provides quick guides and training materials for both groups.	Calls for staff development; training resources emerging.	Offers recommendations and curated educational resources.	Global studies stress insufficient training and lack of institutionalized professional development.
Governance & accountability	Embedded in academic integrity office structures; clear roles suggested.	Linked to university governance agreemets; oversight still incipient.	No clear accountability structure; recommendations open to interpretation.	Reviews show most institutions lack defined roles, monitoring, and accountability mechanisms.
Alignment with global standards	Formal, proactive guidelines; moderately aligned but still developing.	Reactive orientation; alignment gaps with international frameworks.	Early stage; alignment minimal, mostly recommendations.	Global reviews highlight need for harmonization and cross-border standardization of GenAI policies.

Source: Own elaboration.

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6. Conclusion, implications and suggestions

This study combined a SLR with a qualitative Mexican case study to examine regulatory frameworks and institutional governance for adopting LLMs in higher education. Across the reviewed evidence, four persistent governance themes emerged: the fragmentation of policy and regulatory frameworks, the central role of institutional leadership and governance capacity, the predominance of ethical and academic integrity risks, and the organizational change requirements that condition implementation. These results align with international scholarship indicating that higher education institutions are adopting generative AI faster than they are consolidating governance structures capable of ensuring accountability, transparency, and educational quality. The Mexican case strengthens this conclusion by showing how universities are beginning to formalize guidance, yet still face uneven maturity in enforceability, monitoring, and organizational integration.

Three implications follow from these findings. First, universities should move beyond ad hoc recommendations toward comprehensive governance frameworks that define responsibilities, permitted and prohibited uses, disclosure norms, and escalation pathways for integrity breaches, while embedding these elements into existing academic integrity and quality assurance structures. The evidence indicates that policies limited to plagiarism and originality are insufficient to address the broader institutional risks of opacity, bias, and accountability gaps introduced by generative AI in assessment and decision-making processes. Therefore, policy design should explicitly integrate governance mechanisms that are operational, auditable, and aligned with institutional missions.

Second, sustainable adoption requires institutionalized capacity building rather than short-term training initiatives. Both the literature and the Mexican case suggest that faculty and student uncertainty persists when guidance is ambiguous or when instructors lack support to redesign assessment practices and teaching workflows in AI-rich environments. Accordingly, universities should invest in continuous professional development, course-level implementation templates, and assessment redesign toolkits that translate policy into practice and reduce inequities in adoption across departments and programs. This implication is particularly salient in Latin American contexts where institutional resources and governance infrastructures are uneven.

Third, policymakers and regulators should advance harmonized standards that provide universities with clearer baselines for governance while remaining adaptable to local legal and educational systems. The SLR indicates that cross-border inconsistency and regulatory fragmentation constrain institutional decision-making and complicate the implementation of data protection, accountability, and transparency measures. In Mexico, the emergence of institutional guidelines and agreements provides a valuable scaffold, but further alignment is needed to ensure that privacy safeguards, disclosure expectations, and accountability structures can be consistently applied and evaluated across institutional units. Consequently, effective governance will likely depend on coordinated action between institutional leadership and external regulatory frameworks.

The contribution of this study is twofold. Conceptually, it integrates governance and strategic management perspectives with contemporary evidence on generative AI adoption, clarifying how regulatory design and organizational change interact in higher education settings. Practically, it offers an actionable

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governance direction: institutions should adopt a dual-track model that couples policy baselines (scope, disclosure, integrity, privacy) with implementation systems (capacity building, assessment redesign, monitoring workflows) to balance innovation with accountability. While the study is limited by focusing on a single Mexican university case and a bounded set of institutional documents, it identifies concrete governance gaps that can be tested and refined through comparative work.

Future research should expand comparative analysis across Latin American institutions to examine variation in policy maturity, enforcement models, and organizational capacity, as well as to evaluate how governance choices shape teaching practices, student learning, and academic integrity outcomes. In addition, research should assess the effectiveness of specific governance instruments such as disclosure templates, audit trails, and formative assessment alternatives in improving compliance, equity, and trust in AI-mediated educational environments. These next steps are essential for building sustainable, ethically grounded, and context-sensitive governance models for LLM adoption in higher education.

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