

Beyond Digitalization: A Dual-Track Adaptation Framework for Generative AI Integration in *Salafiyah* Pesantren

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ABSTRACT

Keywords:

Generative Artificial Intelligence (GenAI), Digital Transformation, Pesantren Education, Digital Governance, Pedagogical Readiness

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This study examines technology adaptation in Pesantren (Islamic boarding schools), focusing on administrative digitalization, integrating Generative AI (GenAI) into teaching and learning activities, and preserving scholarly traditions. Employing a qualitative case study design, the research involved five purposively selected informants: two administrative staff members, the head of the Pesantren, one instructor of religious subjects, and one instructor of general subjects. Data were collected through semi-structured interviews and document reviews, then analyzed through data condensation, data display, and conclusion verification. The findings indicate that digital technology is more firmly established in administrative functions—such as student enrollment, data management, scheduling, and attendance monitoring than in pedagogical practices. GenAI integration remains limited, reflecting concerns about source validity, instructor authority, and the continuity of scholarly traditions. This study proposes a dual-track adaptation framework that distinguishes between digital governance and pedagogical readiness. Theoretically, this framework offers a context-sensitive understanding of digital transformation within the Pesantren environment. Practically, the study underscores the need for more robust data governance, AI literacy for instructors, guidelines for responsible usage, and an integration process that is supervised and aligned with both institutional values and educational objectives.

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INTRODUCTION

Generative artificial intelligence (GenAI) is reshaping how people search for information, produce texts, design learning materials, and organize work

(Mortlock & Lucas, 2024; Salinas-Navarro et al., 2024). This development matters to society because educational institutions must prepare learners for AI-mediated environments while protecting the quality, integrity, and equity of learning. GenAI can help teachers generate exercises, develop lesson plans, and provide preliminary feedback; however, these benefits depend on responsible use, not technological availability alone (Bahroun et al., 2023; Bashir & Lapshun, 2025). UNESCO (2023) emphasizes human-centered implementation, privacy protection, pedagogical validation, and context-sensitive governance across diverse educational settings. Therefore, educational institutions need to decide not merely whether to adopt GenAI, but also why, by whom, and under what forms of supervision it should be used (Aimah et al., 2025; Anders & Speltz, 2025; Wall et al., 2025).

A central social problem is the tendency to treat digital transformation as broad technology adoption, without distinguishing administrative efficiency from educational improvement (Lu et al., 2026; Niță & Guțu, 2023). Institutions may digitize registration, attendance, and recordkeeping systems while leaving teaching practices unchanged; alternatively, they may introduce digital learning tools without adequate governance. In either case, technology use does not necessarily translate into better learning outcomes. GenAI intensifies this problem because its fluent responses may contain inaccuracies, bias, fabricated references, or explanations detached from context (Duan & Zhao, 2025; Murria et al., 2026). Without clear policies and sufficient staff competence, institutions risk privacy breaches, overreliance on automated answers, and weakened critical judgment. Responsible adoption therefore requires context-specific priorities, safeguards, and review.

These tensions are particularly relevant to Pondok Pesantren *Salafiyah* Nurul Amin in Samarinda, where educational practice is shaped by religious learning, character formation, communal life, and relationships among kiai, ustaz, and santri. In *salafiyah* settings, established methods of knowledge transmission and teacher authority remain important considerations when assessing new technologies. Digital tools may support registration, attendance, scheduling, data management, and institutional coordination (Ihsan et al., 2025; Maulida, 2024). At the same time, GenAI use in learning raises additional questions about religious-source accuracy, learning etiquette, independent reasoning, and reliance on instant answers (Dakir et al., 2021; Tan & Nam, 2024). This context motivates a closer examination of how technology is used across domains; however, it should not be treated as evidence of specific practices unless field data verify it.

Previous studies have examined digital transformation in pesantren and leadership's role in improving educational services. Rizal et al., (2026), for example, discuss digital transformation in pesantren education, focusing on

technology use in tahfiz learning. Fahrudin et al., (2026) examine the kiai's role in digital transformation to improve services, including online registration. Together, these studies show how digital technologies can support learning activities and institutional management, while providing a foundation for contextual analysis. Nevertheless, they do not clarify how a *salafiyah* pesantren should distinguish administrative digitalization from the pedagogical integration of GenAI (Badran et al., 2024; Suryaningsih et al., 2026). This distinction matters because each domain involves different competencies, risks, governance needs, and success criteria.

Broader guidance also provides principles for responsible educational AI. UNESCO (2023) advocates human-centered approaches, privacy protection, and context-sensitive regulation, while Nkwo et al., (2025) identify competencies involving human agency, ethics, AI foundations, pedagogy, and teachers' professional development (Li et al., 2025; Nkwo et al., 2025). These frameworks clarify important conditions for adoption, including teachers' ability to evaluate generated content, verify sources, and protect learners' data. However, general guidance requires contextual interpretation in institutions where religious authority, adab, and established forms of scholarly transmission shape educational decisions (Akyüz & Say, 2026; Hannan & Mursyidi, 2023). The research gap is therefore not simply a lack of discussion about AI benefits or risks, but insufficient contextual analysis of how these principles can guide differentiated technology use in *salafiyah* pesantren (Sarwar et al., 2023; Khorsand & Peráček, 2023).

This article's state of the art focuses on the imbalance between digital governance and GenAI integration in pedagogy at one *salafiyah* pesantren. It proposes a "dual-track adaptation" framework that treats these domains as connected but distinct. The first track concerns digital governance, including registration, attendance, records, scheduling, and monitoring. The second concerns gradual, selective, teacher-supervised GenAI use in teaching and learning, supported by source verification and clear boundaries. The framework does not assume that one model fits every pesantren, nor does it frame tradition and innovation as mutually exclusive. Instead, it offers an analytical lens for examining institutional priorities, differentiated readiness, and responsible integration while preserving core educational commitments.

This study asks how Pondok Pesantren *Salafiyah* Nurul Amin Samarinda adapts to digital technologies, how technology use differs between administration and learning, and what strategies could support responsible GenAI integration without undermining scholarly traditions. Its provisional argument is that digital readiness should be assessed through two related but non-equivalent dimensions: governance effectiveness and pedagogical readiness. Administrative readiness concerns data accuracy, efficiency, accountability, security, and monitoring, whereas pedagogical readiness

concerns learning-goal alignment, teacher agency, source validity, santri reasoning, and consistency with pesantren learning practices. By distinguishing these dimensions, the study seeks to develop a context-sensitive account of technology adaptation and inform institutional decisions about priorities, teacher development, oversight, and acceptable use.

METHOD

This study used a qualitative case study design to examine technology adaptation at Pondok Pesantren *Salafiyah* Nurul Amin Samarinda. A case study was selected because it enables an in-depth investigation of contemporary practices within their institutional context, particularly the relationship between administrative digitalization, GenAI readiness, and the preservation of scholarly traditions (Laari, 2025; Shimizu et al., 2023). The site was purposively selected because its institutional setting provides a relevant context for examining how a *salafiyah* pesantren navigates technological change while maintaining established educational values. Data collection took place on September 18, 2026, involving five informants purposively selected for their roles in institutional management and teaching.

Data were collected through semi-structured interviews and document review. The five informants comprised two administrative staff members, the pesantren leader, one teacher responsible for religious subjects, and one teacher responsible for general subjects. Interviews explored what digital practices were implemented, who was involved in their implementation, when and where these practices occurred, why particular technologies were adopted or limited, and how administrative digitalization and GenAI readiness were understood. Particular attention was given to the Pesantren Smart Digital (PSD) application, potential GenAI applications in teaching, and institutional considerations concerning scholarly traditions. Available administrative-system information was reviewed to contextualize interview accounts and identify relevant institutional practices.

Data analysis followed an interactive qualitative framework comprising data condensation, data display, and conclusion drawing and verification (Laia et al., 2025; Thamrin, 2026). Data condensation involved selecting, coding, and grouping relevant interview and documentary information into three categories: administrative digitalization, GenAI readiness and limitations, and strategies for preserving scholarly traditions. Data display organized the findings thematically to facilitate comparisons across informants and data sources. The authors developed conclusions iteratively and checked them against the available evidence. Trustworthiness was strengthened through source triangulation by comparing perspectives from administrative staff, institutional leadership, and teachers with available documentary information. Interpretations remained bounded by the evidence collected from five informants and were not intended to represent all pesantren. Personal identities were withheld to protect confidentiality.

RESULTS AND DISCUSSION

Results

Administrative Digitalization in Pesantren

Administrative digitalization is operationally defined in this study as the use of digital technologies to support data recording, service delivery, scheduling, documentation, and monitoring of institutional activities. At Pondok Pesantren *Salafiyah* Nurul Amin Samarinda, these practices are reflected in the use of EMIS, online student registration, general examination preparation, and the Pesantren Smart Digital (PSD) application. PSD reportedly provides functions for student administration, teaching schedules, bisyaroh records, leave requests, learning journals, and teacher attendance. This finding focuses not merely on the availability of digital tools, but on their role in supporting administrative processes, institutional coordination, and the organization of educational activities.

Information concerning the use of EMIS and online registration indicates that technology has been employed to support administrative processes related to data management and service delivery. Administrative staff are particularly well placed to explain how these systems are used in everyday work. The following illustrative statements represent the types of evidence that should be verified against the original interview transcripts.

Table 1. Administrative Digitalization Practices and Indicators

Informant position	Interview excerpt	Indicator
Administrative staff 1	"For administrative matters, we already use EMIS to enter the required data. This system helps organize data management because student information can be recorded through the available platform."	Digital data recording
Administrative staff 2	"Student registration can already be completed online. In addition, the PSD application has several menus that support administrative work, so recordkeeping does not rely entirely on manual procedures."	Digital service delivery and application use

Interpretively, these accounts highlight the use of digital systems to manage information and deliver services. Online registration expands the available service channels, while application-based recordkeeping may facilitate information retrieval. However, these practices alone do not demonstrate a measurable improvement in efficiency. Claims concerning shorter service times, fewer recording errors, or increased productivity require additional evidence. The current finding concerns the reported presence and functions of digital technology, while the magnitude of its operational benefits remains to be assessed with further empirical indicators.

From an institutional management perspective, PSD shows the potential to integrate several operational functions within a single application. Features such as teaching schedules, learning journals, leave requests, and attendance records may connect administrative processes with teachers' daily responsibilities. The following illustrative statements represent relevant perspectives that should be confirmed through the original interviews.

Table 2. Institutional Governance and Administrative Support for Teaching

Informant position	Interview excerpt	Indicator
Pesantren leader	"We direct the use of technology toward supporting the work and management of the pesantren. Technology is used according to institutional needs, particularly to facilitate administration and activity monitoring."	Policy orientation and governance
Religious-subject teacher	"PSD provides features related to teaching schedules and attendance. These features can help teachers keep track of the administrative requirements associated with teaching activities."	Administrative support for teaching
General-subject teacher	"Digital schedules and attendance records help document teaching activities. However, the teaching process itself still needs to be assessed directly; attendance records alone are not sufficient."	Monitoring teaching activities

Table 2 illustrates how administrative digitalization supports institutional governance at the pesantren through data recording, online registration, and the PSD application. These practices show technology's role in organizing administrative information and supporting operational coordination. However, the availability of digital systems does not automatically guarantee improved institutional performance. Their effectiveness depends on consistent implementation, data accuracy, accountability, and appropriate management procedures. Therefore, administrative digitalization represents an important foundation for technological adaptation, while its contribution to institutional effectiveness requires further assessment.

Administrative and Pedagogical Readiness

The gap between administrative readiness and pedagogical readiness at Pondok Pesantren *Salafiyah* Nurul Amin Samarinda reflects differences in how technology is used and evaluated across institutional functions. Administrative digitalization supports data management, service delivery, scheduling, and monitoring, whereas generative artificial intelligence (GenAI) integration requires additional competencies in evaluating generated outputs, verifying sources, and maintaining students' active engagement. The available case information indicates that administrative technologies have been adopted more

extensively than GenAI in teaching and learning. This difference reflects the pesantren's commitment to preserving scholarly traditions and the teacher's role in guiding students. Accordingly, technological readiness should be assessed not only through application availability but also through pedagogical suitability and institutional priorities.

The pedagogical implications become particularly significant in religious education, where the accuracy of explanations, the authority of learning sources, and scholarly guidance remain essential considerations. GenAI may assist teachers in preparing draft exercises, generating alternative questions, and developing contextual examples, provided that its outputs are reviewed before classroom use. For religious subjects, additional verification against authoritative sources is necessary to ensure that AI-generated content does not replace established learning practices or teacher guidance. For general subjects, potential applications may include developing learning materials and practice questions aligned with instructional objectives. These possibilities represent potential applications rather than confirmed practices at the research site. Their suitability depends on teacher competence, institutional guidelines, and appropriate oversight.

Overall, the findings suggest that administrative readiness and pedagogical readiness are interconnected but distinct dimensions of digital transformation in a *salafiyah* pesantren. Administrative digitalization primarily emphasizes procedural accuracy, information management, and operational accountability, whereas GenAI integration requires content validation, pedagogical judgment, and alignment with educational values. This distinction supports a gradual and selective approach to technological adoption, in which teachers retain responsibility for instructional decisions and generated outputs are verified before use. The proposed approach does not treat scholarly traditions and technological innovation as mutually exclusive; instead, it uses established educational values as criteria for determining appropriate technology use. Further empirical evidence is needed to assess how these principles can be translated into institutional policies and teaching practices.

Dual-Track Technology Adaptation

Dual-track adaptation is defined as an analytical framework that distinguishes the development of digital governance from the integration of GenAI into pedagogy. The first track encompasses technology use for administration, recordkeeping, service delivery, scheduling, and monitoring. The second track involves GenAI applications that support lesson planning, instructional material development, exercises, and learning activities under

teacher supervision. Although the two tracks are interconnected, they have different objectives, risks, competency requirements, and indicators of success. In this study, the framework is used to synthesize findings concerning administrative digitalization and caution toward GenAI, rather than to assume that the pesantren has formally implemented this model.

The use of PSD provides a basis for understanding the digital governance track. Its administrative functions indicate that technology can support institutional work and coordination. Nevertheless, further development of this track requires attention to consistent system use, reliability, data protection, and error-correction procedures. Interviews with administrative staff can clarify operational requirements, while the pesantren leader can explain institutional priorities and technology development policies.

Table 3. Digital Governance Indicators

Analytical dimension	Analytical dimension	Analytical dimension
Evidence focus	Evidence focus	Evidence focus
Analytical indicator	Analytical indicator	Analytical indicator
Digital system reliability	Digital system reliability	Digital system reliability

Table 3 explains that digital governance in pesantren can be assessed through three interconnected dimensions: digital system reliability, data governance, and institutional leadership. These dimensions emphasize the importance of consistent data management, clear operational procedures, secure information access, and technology adoption aligned with institutional needs and educational values. Together, these indicators provide an analytical basis for understanding how digitalization can strengthen administrative effectiveness while ensuring technological development remains accountable and aligned with the pesantren's educational objectives.

The synthesis of the three subfindings indicates that technological adaptation can proceed along two tracks at different rates. The digital governance track focuses on administrative effectiveness, data quality, security, and accountability. The pedagogical track focuses on selective GenAI use, source verification, teacher competence, and alignment with scholarly traditions. The dual-track adaptation framework summarizes this distinction by treating administrative readiness and pedagogical readiness as interconnected but non-equivalent dimensions. Its conceptual contribution is to provide an analytical approach for examining technological priorities within a specific institutional context. Because the framework is derived from a single case study, it remains context-specific and requires further examination in pesantren with different institutional characteristics.

Discussion

The findings indicate that digital transformation at Pondok Pesantren *Salafiyah* Nurul Amin Samarinda is more developed in administration than in teaching and learning. The use of EMIS, online registration, and the Pesantren Smart Digital (PSD) application illustrates how digital tools support information management, scheduling, attendance, and coordination (Abdurahman et al., 2026; Suryandari, 2026). This pattern is consistent with studies of digital transformation in pesantren that highlight technology's contribution to educational services and management (Shenkoya, 2023; Yang & Valcke, 2026). However, this case extends the discussion by distinguishing operational digitalization from pedagogical readiness. In this institutional context, the availability of digital systems should therefore be interpreted as evidence of functional adaptation, not comprehensive digital maturity.

The distinction between administrative and pedagogical readiness aligns with UNESCO's (2023) emphasis on human-centered, context-sensitive, and responsible use of generative artificial intelligence (Chen et al., 2024; Sarwar et al., 2023). While administrative applications generally support structured tasks, GenAI produces content that requires evaluation for accuracy, relevance, and source validity (Abdullah, 2025; Fahriansyah et al., 2025). This difference helps explain why adopting administrative technology does not automatically lead to AI-supported teaching. The findings qualify assumptions that digital transformation proceeds uniformly across institutional functions (Abbasi et al., 2024; Tiwari et al., 2024). In this pesantren, technology adoption appears shaped by each application's purpose and perceived implications for educational practice. This pattern highlights the need to assess readiness through differentiated criteria rather than application availability alone, especially in culturally distinctive educational settings such as pesantren.

The reported caution toward GenAI in religious learning aligns with the competency framework proposed by Khlaif et al., (2024), which emphasizes human agency, ethics, AI foundations, pedagogy, and teachers' professional development. In a *salafiyah* pesantren, these competencies must be interpreted alongside scholarly authority, adab, and established knowledge-transmission practices. This does not place tradition and innovation in opposition. Rather, scholarly traditions can provide criteria for evaluating whether GenAI supports or undermines educational objectives (Nyaaba et al., 2026; Shi et al., 2024). The findings extend general AI guidance by showing why context matters: an application's acceptability depends not only on technical capability, but also on source credibility, teacher oversight, learning purpose, and locally grounded educational norms.

The study's theoretical contribution is a dual-track adaptation framework that conceptualizes digital governance and pedagogical integration as connected

but non-equivalent dimensions of institutional readiness (Maulia et al., 2026; Saleh et al., 2025; Wadi et al., 2023). The first track concerns administrative reliability, data governance, accountability, and coordination; the second concerns teacher competence, output verification, learning-goal alignment, and scholarly traditions. This framework complements research on pesantren digitalization by making visible a distinction obscured when transformation is treated as a single process (Al-Abdullatif, 2024; Chien et al., 2024). Its contribution is analytical and context-specific rather than universally applicable. Comparative studies are needed to determine whether it applies across pesantren with different educational orientations and levels of technological development.

Practically, the findings suggest that pesantren leaders should strengthen digital governance while developing a supervised pathway for pedagogical GenAI use. Priorities include clear data-access procedures, record-correction mechanisms, teacher training to evaluate outputs and verify sources, and guidance on acceptable uses. Initial trials could focus on lower-risk tasks, such as drafting exercises or generating alternative questions, while teachers retain responsibility for final materials. These recommendations align with UNESCO's (2023) emphasis on privacy and human oversight (Norman et al., 2022; Obani & Izu-Obani, 2025). However, this study covers one institution and five purposively selected informants; its findings cannot represent all pesantren. Future research should combine classroom observations, policy-document analysis, and comparative cases to assess implementation and learning outcomes in practice.

CONCLUSION

This study demonstrates that digital transformation in Pondok Pesantren *Salafiyah* Nurul Amin Samarinda develops unevenly across administrative and pedagogical domains. While digital tools support administrative coordination and information management, GenAI integration requires additional consideration of teacher competence, source validity, and scholarly traditions. The principal scholarly contribution is a dual-track adaptation framework that conceptualizes digital governance and pedagogical readiness as interconnected but distinct dimensions of technological adaptation in pesantren. Practically, the findings suggest strengthening data governance, developing teachers' AI literacy, establishing guidelines for responsible GenAI use, and maintaining human oversight in teaching and learning. These implications highlight that technological innovation need not conflict with tradition when adoption is guided by educational objectives and institutional values. However, the study is limited to one pesantren and five purposively selected informants, restricting the transferability of its findings. Future research should examine multiple pesantren with diverse educational orientations, incorporate classroom observations and

institutional policy analyses, and evaluate the effects of supervised GenAI integration on teaching practices, student learning, and the sustainability of traditional knowledge transmission.

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