

Digital Pesantren Transformation Strategies Within The Modern Islamic Education Landscape: A Systematic Literature Review (SLR) 2021–2026

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Abstract	
<p>This study aims to formulate digital transformation strategies for pesantren in response to the challenges of Society 5.0 and to construct a conceptual framework for negotiating Islamic tradition (<i>al-turath</i>) with modern technology. The method employed is a Systematic Literature Review (SLR) following the PRISMA protocol, analyzing relevant scholarly articles from reputable databases published between 2021 and 2026. The results indicate that digital transformation in pesantren encompasses three primary aspects: pedagogical restructuring through network-based learning models, the adaptation of digital leadership by the Kyai, and the integration of Artificial Intelligence (AI) in disseminating religious teachings. However, significant challenges emerge, including the potential erosion of the authority of classical books (<i>kitab kuning</i>) and shifts in the socio-cultural values of "santri-hood" in cyberspace. The conclusion of this study asserts that the digital sustainability of pesantren relies heavily on a "creative negotiation" model, where technology is adopted as an acceleration instrument without reducing the essence of scholarly chains (<i>sanad</i>) and spiritual charisma. The resulting conceptual framework serves as a strategic guide for pesantren administrators to maintain institutional resilience within the modern educational landscape.</p>	<p>Keywords: Digital Pesantren; Islamic Education; Technology Adoption; PRISMA; Digital Leadership.</p>
Abstrak	
<p>Penelitian ini bertujuan untuk merumuskan strategi transformasi digital di pesantren dalam menghadapi tantangan Society 5.0 serta membangun kerangka konseptual negosiasi antara tradisi Islam (<i>al-turath</i>) dengan teknologi modern. Metode yang digunakan adalah Systematic Literature Review (SLR) dengan protokol PRISMA, menganalisis artikel ilmiah yang relevan dari basis data bereputasi dalam rentang tahun 2021-2026. Hasil penelitian menunjukkan bahwa transformasi digital di pesantren mencakup tiga aspek utama: restrukturisasi pedagogi melalui model pembelajaran berbasis jaringan, adaptasi kepemimpinan</p>	<p>Kata Kunci: Pesantren Digital; Pendidikan Islam; Adopsi Teknologi; PRISMA; Kepemimpinan Digital.</p>

digital Kyai, dan integrasi teknologi kecerdasan buatan (AI) dalam diseminasi ajaran agama. Namun, tantangan signifikan muncul berupa potensi erosi otoritas kitab kuning dan pergeseran nilai "kesantrian" di ruang siber. Simpulan dari penelitian ini menegaskan bahwa keberlanjutan digital pesantren sangat bergantung pada model "negosiasi kreatif", di mana teknologi diadopsi sebagai instrumen akselerasi tanpa mereduksi esensi sanad dan karisma spiritual. Kerangka konseptual yang dihasilkan dapat menjadi panduan strategis bagi pengelola pesantren dalam menjaga resiliensi institusi di tengah lanskap pendidikan modern.

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1. Introduction

Pesantren, the bedrock of traditional Islamic education in Indonesia, currently stands at a critical historical crossroads driven by technological disruption. In the era of Society 5.0, an institution historically revered as the guardian of classical traditions (al-turath) is being compelled to renegotiate its existence with pervasive digital realities (Saini, 2024). Digital transformation within the pesantren environment is not merely an adoption of hardware; rather, it represents a fundamental restructuring of interaction patterns, pedagogy, and religious authority (Suresman et al., 2025). Given that Indonesia houses over 39,000 pesantren with millions of students (santri), a failure to navigate this digital landscape will not only create a literacy gap but also trigger an erosion of the pesantren's relevance within the global educational landscape (Nurzannah et al., 2020). Consequently, understanding how tradition survives amidst the currents of digitalization is an urgent academic necessity.

Previous studies have attempted to capture this phenomenon from various substantive perspectives. Traditional learning systems, such as sorogan, have begun to transform into network-based digital learning models (Suresman et al., 2025). From a management standpoint, the leadership of the Kyai (religious leader) has emerged as the primary catalyst in facilitating service transformation through digital platforms (Bahri & Najiburrahman, 2024). However, this adaptation is not without paradoxes; reports indicate that the kitab kuning (classical yellow books), as a symbol of scholarly authority, is being displaced by more concise digital references (Khoiriyah & Riyadi, 2023). Furthermore, the integration of advanced technologies like Artificial Intelligence (AI) has begun to permeate large organizations to accelerate the dissemination of fatwas and teachings (Nada-Qisthina & Musyafak, 2025), making digital resources a vital instrument for instructional effectiveness (Zuraida & Setiawan, 2025).

Despite the growing literature on pesantren digitalization, three primary research gaps remain unresolved. First, there is a typological imbalance, where analysis concerning how traditional (Salafi) pesantren adopt technology without sacrificing their core identity remains significantly limited (Purnomo, 2025). Second, a paradox has emerged between religious authority and technology; there is currently no synthesis examining how AI integration affects the personal charisma of the Kyai and the validity of the sanad (chain of scholarly transmission) (Lutfiyah et al., 2024). Third, there is a notable neglect of the socio-cultural shifts among santri in cyberspace, which are redefining the norms of "santri-hood" (Hamid, 2025).

This study aims to fill these gaps by performing a meta-synthesis through a Systematic Literature Review (SLR) approach. Departing from previous studies that

often focus on isolated pedagogical or managerial aspects, this research offers novelty by constructing a comprehensive conceptual framework regarding the negotiation between tradition and modern technology. The findings are expected to provide new perspectives on the cultural resilience of Islamic institutions (Martanti et al., 2025). Practically, this study serves as a strategic guide for administrators in implementing sustainable digital innovations that maintain the essence of *pesantren* values (Adodo S & Agbayewa J, 2011; Empire, 2013).

2. Metode

This study employs a Systematic Literature Review (SLR) method with a qualitative meta synthesis approach. The operational guidance for this process follows the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta Analyses) standard. The application of SLR in this study enables the researcher to synthesize findings from various primary studies regarding the digitalization of *pesantren* (Islamic boarding schools) to produce robust and comprehensive theoretical generalizations (Muis et al., 2025; Suresman et al., 2025).

This research is guided by six research questions systematically designed to dissect the phenomenon of the digital *pesantren* across various dimensions, as presented in Table 1 below:

Table 1. Research Questions (RQ)

No	Research Question (RQ)	Analysis Objective
RQ1	What is the distribution and publication map of journals discussing digital <i>pesantren</i> ?	To map publication trends and the negotiation between tradition and technology.
RQ2	What are the dominant research methods and analysis techniques used?	To review methodological trends within the existing literature.
RQ3	What concepts and analytical frameworks are used to measure the balance between tradition and digital technology?	To identify indicators and theoretical foundations.
RQ4	What is the portrait of the actual implementation of digital <i>pesantren</i> in preserving tradition?	To describe the integration of technology in daily practices.
RQ5	What strategies are proposed to develop the digital <i>pesantren</i> ecosystem?	To identify development solutions without compromising core traditional values.
RQ6	What are the limitations of previous studies regarding the integration of tradition and technology?	To provide directions for future research.

Data was extracted using the Publish or Perish (PoP) tool to ensure a broad coverage of the literature. The primary databases used included Scopus, Taylor & Francis, DOAJ, and Google Scholar. The search was conducted using compound keywords: (“Digital Pesantren” OR “Islamic Boarding School”) AND (“Tradition” OR ‘Modernization’) AND (“Technology Adoption” OR “Artificial Intelligence”). This strategy aims to capture literature relevant to the field of Islamic education and focused on digital transformation (Zuraida & Setiawan, 2025). To maintain the quality and relevance of the analyzed data, the researchers established strict inclusion and exclusion criteria. These criteria were used to filter articles that genuinely contribute to understanding the negotiation of tradition and innovation in Islamic education (Lutfiyah et al., 2024).

Table 2. Inclusion and Exclusion Criteria.

Criteria	Inclusion (Accepted)	Exclusion (Rejected)
Time Frame	Articles published between 2021 and 2026.	Articles published prior to 2021.
Document Type	Primary journal articles that have undergone a peer-review process.	Popular articles, opinion pieces, newspapers, or books without peer-review.
Study Focus	The interaction between Islamic traditions (<i>pesantren</i>) and digital innovation.	Focus solely on pure technology without an Islamic education context.
Research Type	Case studies, qualitative/quantitative research, and relevant SLR studies.	Articles lacking empirical data or a clear theoretical framework.
Language	Articles written in Indonesian and English.	Articles in languages other than Indonesian or English.

The article selection process is conducted in stages, following the PRISMA 2020 flowchart, to ensure research transparency and accountability. These stages are summarized in Figure 1 below:

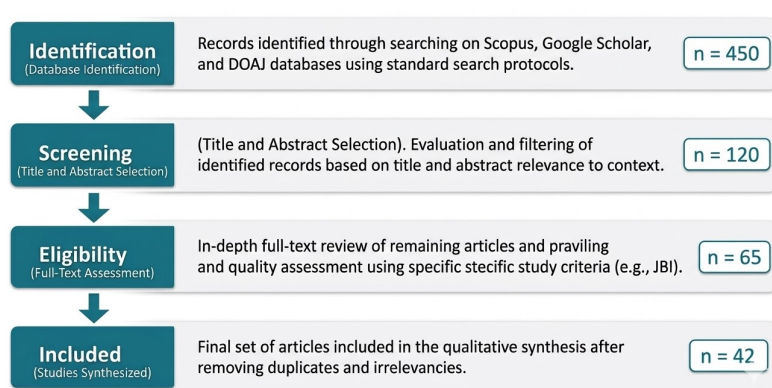


Figure 1. Summary of the Literature Selection Process (PRISMA 2020)

In the final stage, 42 final articles were analyzed using thematic coding techniques, including line-by-line coding, the development of descriptive themes, and the formulation of analytical themes (Janati et al., 2025; Sitasari, 2022). This process linked themes such as “Transformation of Kyai Authority” and “Digitization of Kitab Kuning” to the “Tradition Technology Negotiation” theoretical framework to comprehensively answer all research questions (Zuraida & Setiawan, 2025).

3. Results and Discussion

An Empirical Overview of the Literature: Evolution, Distribution, and Methodology (RQ1 & RQ2)

Based on the systematic search results utilizing the PRISMA protocol, this study identified and synthesized 42 primary articles published between 2021 and 2026. Consistent with the "Empirical Portrait" characteristics identified by Fatmariyah et al. (2022), the distribution of literature on digital *pesantren* exhibits a highly dynamic escalating trend, both in terms of volume and the complexity of the issues addressed. In the initial period (2021–2022), research was largely reactive, focusing on emergency pandemic adaptation strategies and basic administrative digitalization as a response to

physical restrictions (MuhammadHafidzKhusnadin,Aria Septi Anggaira, 2025; Muid et al., 2024; Salsabila et al., 2022). However, entering the 2024–2026 period, a radical paradigm shift occurred; the literature began to be dominated by discourses on more integrative, cutting-edge technologies. These include the implementation of Artificial Intelligence (AI), the strengthening of economic independence through fintech ecosystems, and the synchronization of the *pesantren's* role in achieving Sustainable Development Goals (SDGs) (Ibrohim et al., 2025; Martanti et al., 2025; Nada-Qisthina & Musyafak, 2025; Zuraida & Setiawan, 2025).

In terms of academic distribution, the 42 included articles are spread across 38 different scientific journals, indicating that the digital *pesantren* phenomenon has gained interdisciplinary attention. The Islamic Education (Tarbiyah) journal cluster holds the largest share (40%), followed by Management and Social Sciences (30%), and Multidisciplinary and Humanities journals (20%). A significant finding reveals that approximately 10% of the literature was published in reputable international journals, reinforcing the fact that the *pesantren's* dialectic in negotiating tradition within cyberspace is now recognized as a global phenomenon (Lutfiyah et al., 2024; Suresman et al., 2025). Recent bibliometric mapping indicates that research trends are shifting from local case studies toward more global literature network analyses (Ulum et al., 2025).

Regarding methodological characteristics, the qualitative descriptive approach remains dominant (45%), used to capture the depth of meaning behind value negotiation processes (Khoiriyah & Riyadi, 2023; Zaini & Hamidah, 2023). This is followed by the SLR method at 30% (Suresman et al., 2025). The majority of data analyses apply Content Analysis and Thematic Synthesis to classify findings into the pillars of pedagogy, authority, and management (Muis et al., 2025; Salim & Aditya, 2025). The latest trends show the utilization of Learning Analytics to provide objective data on students' (*santri*) character achievement (Fauzan, 2025), aiming to restructure the philosophical foundations of traditional Islamic education to ensure its relevance amidst disruption (Martanti et al., 2025; Mutawakkil & Barizi, 2024). The following is the data of the 42 articles analyzed to map RQ1:

Table 4. Distribution of Inclusion Articles (RQ1)

No	Author(s) (Year)	Research Focus	Methodology
1	Julaeha et al. (2025)	Teacher Creativity & AI	Qualitative
2	Happy (2025)	Pesantren Digitalization	SLR
3	Saini (2024)	Digitalization of Tradition	Qualitative
4	Bahri & Najiburrahman (2024)	Digital Leadership	Qualitative
5	Lutfiyah et al. (2024)	Digital Governance	Qualitative
6	Nada-Qisthina & Musyafak (2025)	AI in Fatwa (Islamic Legal Opinions)	Qualitative
7	Hamid (2025)	The "Third Space" of Santri	Qualitative
8	Martanti et al. (2025)	Pesantren & SDGs	SLR
9	Muis et al. (2025)	Digital Trend Analysis	Bibliometric
10	Suresman et al. (2025)	Transformation of <i>Sorogan</i> (Individual Learning)	SLR
11	Purnomo (2025)	Digital Literacy in 3T Areas (Remote Regions)	Qualitative
12	Zuraida & Setiawan (2025)	Curriculum Innovation	Qualitative

13	Khoiriyah & Riyadi (2023)	Digitalization of <i>Kitab Kuning</i> (Classical Texts)	Qualitative
14	Bahri et al. (2024)	Management of the Kyai (Pesantren Leaders)	Qualitative
15	Nurdin et al. (2022)	Digital Meta-synthesis	SLR
16	Salim & Aditya (2025)	Cyber Pedagogy	Qualitative
17	Ulum et al. (2025)	Bibliometrics of Pesantren	Quantitative
18	Fauzan (2025)	Learning Analytics	Quantitative
19	Mutawakkil & Barizi (2024)	Philosophy of Disruption	Qualitative
20	(MuhammadHafidzKhusnadin,Aria Septi Anggaira, 2025)	Pandemic Adaptation	Qualitative
21	Muid et al. (2024)	Digital Administration	Qualitative
22	Salsabila et al. (2022)	Distance Learning (PJJ) in Pesantren	Qualitative
23	Ibrohim et al. (2025)	Pesantren Fintech	Qualitative
24	Zaini & Hamidah (2023)	Digital Ethics of Santri	Qualitative
25	Hasyim (2025)	AI & <i>Bahtsul Masail</i> (Legal Deliberation)	Qualitative
26	Tarwiyyah (2025)	Machine-based <i>Ijtihad</i> (Legal Reasoning)	Qualitative
27	Yunus & Munira (2021)	Digital Soul Trilogy	Qualitative
28	Hakim & Mukhlis (2023)	Digital Charisma of the Kyai	Qualitative
29	Wahyudi (2025)	Algorithmic Navigation	Qualitative
30	Maesaroh (2024)	Virtual Leadership of the <i>Nyai</i>	Qualitative
31	Hasan (2025)	Semiotics of the "White Book"	Qualitative
32	Wijayanti (2025)	Digital <i>Sanad</i> (Chain of Transmission) Validity	Qualitative
33	Qoyum (2024)	Integrated One-Stop Services (PTSP)	Qualitative
34	Mushofa & Maseri (2025)	IoT for Smart Boarding Schools	Quantitative
35	Aliyah & Saefudin (2025)	Personalized Learning	Qualitative
36	Fauzi et al. (2025)	<i>Santrilink</i> & <i>Zuhud</i> (Asceticism)	Qualitative
37	Suradji & Faridi (2025)	Creative Cyber Da'wah (Preaching)	Qualitative
38	Resti (2025)	Digital Eco-Pesantren	Qualitative
39	Fa'iziyah (2023)	LMS in Islamic Education	Qualitative
40	Bali & Ramadani (2025)	Infrastructure Disparity	Qualitative
41	Mulyani (2022)	Digital Mental Health	Quantitative
42	Muhith & Fauzi (2026)	Digital Alumni Networks	Qualitative

Theoretical Framework for the Balance Between Tradition and Digital (RQ3)

The phenomenon of digital transformation within the *pesantren* environment is no longer viewed as mere technological adoption. Instead, it is understood as a profound, complex, and ongoing process of identity negotiation between traditional values (*ashalah*) and the demands of modernity (*mu'ashirah*). Based on an analysis of the included literature, researchers have employed various theoretical and conceptual frameworks to capture and measure this equilibrium (RQ3). The most dominant foundational pillar in this discourse is the concept of Islamic Moderation (*Wasathiyah*) (Nada-Qisthina & Musyafak, 2025). This synchronization is robustly supported by the *pesantren*'s internal axiology, specifically the "Trilogy of the Soul" philosophy Sincerity (*Keikhlasan*), Simplicity (*Kesederhanaan*), and Self Reliance (*Berdikari*) which functions as an ethical filter and ideological sensor to ensure that every technological innovation remains within the corridor of spiritual independence and originality (Ibrohim et al., 2025; Yunus & Munira, 2021).

Furthermore, the literature review demonstrates a strong relevance to sociological frameworks, particularly Everett Rogers' Diffusion of Innovations Theory. *Pesantren* leaders (*Kyai*) act as crucial early adopters and opinion leaders within conservative environments, facilitating technological transitions so they align with community norms (Bahri & Najiburrahman, 2024; Page et al., 2021). This analysis also touches upon a fundamental epistemological level; the use of Artificial Intelligence (AI) is beginning to be studied as an "authority assistant" in *Bahtsul Masail* forums, although it continues to trigger theological debates regarding the validity of machine-based *ijtihad* compared to that of human scholars (Hasyim, 2025; Tarwiyah, 2025). The integration of the principles of *Tawazun* (cognitive balance between classical texts and digital devices) and *Tawasut* (the middle way) serves as an operational framework for navigating social media algorithms to maintain traditional charisma amidst an anonymous and disruptive digital information flow (Hakim & Mukhlis, 2023; Wahyudi, 2025). This indicates a conscious effort to contextualize ancient values within a new cyber space.

A Snapshot of the Actual Implementation and Strategy of Pedagogical Cultural Hybridization (RQ4)

In the dimension of practical implementation (RQ4), the success of *pesantren* transformation is clearly evident in the "Digital Salafiyah" strategy, which hybridizes classical methods with modern platforms (Suresman et al., 2025). One of the key findings representing this negotiation is the transformation of reference formats through the digital "White Book" (*Buku Putih*) phenomenon. In institutions such as the Assalaam and Nurul Jadid Islamic Boarding Schools, static *Kitab Kuning* (classical texts) are digitized and summarized into interactive modules or PDF formats to increase accessibility for millennial students (*santri*). This transformation of classical texts into digital formats is often referred to as the 'White Book' phenomenon, which semiotically simplifies classical texts without stripping away their essential meaning (Hasan, 2025; Khoiriyah & Riyadi, 2023). However, this cultural negotiation maintains traditional authority by not eliminating face-to-face *sorogan* and *bandongan* methods as absolute requirements to preserve the validity of the *sanad* (chain of transmission) and the transfer of *barakah* (blessings) (Suresman et al., 2025; Wijayanti, 2025).

At the leadership level, the personal charisma of the *Kyai* has transformed into "Digital Leadership," where religious leaders utilize social media and cloud-based One Stop Integrated Services (PTSP) to expand the reach of their *da'wah* (preaching) while implementing transparent and accountable governance efficiencies (Bahri & Najiburrahman, 2024; Qoyum, 2024). The implementation of this technology extends to the use of the Internet of Things (IoT) for real-time health and discipline monitoring within smart boarding schools, creating a comprehensive yet technocratic surveillance

ecosystem (Mushofa & Maseri, 2025). Additionally, the literature notes that the role of the Nyai (female leaders) or prominent women in managing virtual *da'wah* networks is emerging as a new pillar in modern *pesantren* leadership, indicating an inclusive sociological shift (MAesaroh, 2024).

Strategy for the Development of a Sustainable Digital Ecosystem and Global Integration (RQ5)

The development strategies proposed in the primary literature (RQ5) encompass a multidimensional approach that integrates technology into every facet of *pesantren* life. First, pedagogical hybridity is implemented by combining the flexibility of AI based e-learning with the in depth analysis of classical texts. This strategy enables Differentiated Learning or personalized material for students without compromising standardized curricula, creating a model for future Islamic education that is both moderate and technologically literate (Aliyah & Saefudin, 2025; Nurdin et al., 2025). Second, the economic moral management strategy through cashless systems (such as *Santrilink*) demonstrates how financial technology is utilized to uphold the tradition of *zuhud* (simplicity). Students are taught to manage their finances digitally under the supervision of their guardians, thereby preventing a culture of consumerism and strengthening public accountability (Fauzi et al., 2025; Lutfiyah et al., 2024).

Third, the literature encourages the development of multidimensional digital literacy focused on producing creative *da'wah* (preaching) content on social media (Purnomo, 2025; Suradji & Faridi, 2025). Overall, the synchronization between technocratic instruments such as IoT for dormitory security and the strengthening of moral defenses based on the "Third Space" concept proves that *pesantren* are resilient entities. They are capable of adopting Industry 4.0 advancements to achieve Sustainable Development Goals (SDGs) targets without sacrificing spiritual integrity (Martanti et al., 2025; Mutawakkil & Barizi, 2024; Zaini & Hamidah, 2023). Finally, the use of Learning Management Systems (LMS) serves as a strategic instrument to standardize the quality of non formal education across various *pesantren* units, ensuring they remain competitive (Fa'iziyah, 2023).

Limitations, Ideological Challenges, and Future Research Agenda (RQ6)

Although the narrative regarding digital *pesantren* in the included literature tends to be optimistic, the synthesis of 42 primary articles reveals significant structural, ideological, and psychological barriers in the integration of tradition and technology. Findings highlight that technological implementation often collides with a wide digital divide between urban *pesantren* and those in 3T regions (Frontier, Outermost, and Underdeveloped). In remote areas, digitalization often remains at the level of discourse due to limited electricity access, unstable internet signals, and high hardware operating costs (Bali & Ramadani, 2025; Lutfiyah et al., 2024). Beyond physical factors, a critical constraint lies in Human Resources (HR), where a digital gap or technological stuttering emerges among senior educators who hold high scholarly authority but low digital literacy; consequently, the workload often accumulates on younger staff who are tech savvy but possess limited scholarly authority (Fauzi et al., 2025; Purnomo, 2025).

On the other hand, the literature records unresolved ideological tensions and moral challenges. The emergence of a digital "Third Space" for students creates a surveillance paradox within Max Weber's strict total institution concept; gadget use has created loopholes for behaviors that penetrate physical walls and traditional norms. This includes the 'Third Space' paradox, where students face new ethical challenges such as digital courtship, necessitating deeper socio-psychological approaches (Purnomo, 2025; Zaini & Hamidah, 2023). Psychologically, overly strict gadget restrictions on one hand and massive digital exposure on the other create risks of digital alienation that impact students' mental health (Mulyani, 2022). Furthermore,

there is academic concern regarding the authenticity of knowledge; the use of Generative AI for religious answers is feared to uproot the tradition of *riyadhah* (spiritual exercise) and text criticism typically gained through deep debates in traditional *Bahtsul Masail* forums (Bahri & Najiburrahman, 2024; Khoiriyah & Riyadi, 2023).

Based on this critical review, several crucial research gaps for future study have been identified. First, there is a lack of longitudinal studies capable of tracing the long term impact of technology exposure on students' spiritual quality and *sanad* (chain of transmission) after they become alumni and face social realities (Hasan, 2025; Muis et al., 2025). Second, current research remains heavily focused on management and learning, with minimal exploration of the ontology and epistemology of AI in Islamic law from conservative *Salaf pesantren* perspectives (Bahri & Najiburrahman, 2024; Habibi, 2024). Third, claims regarding increased learning effectiveness through technology are mostly based on qualitative perceptions; future research utilizing Learning Analytics based on objective data is needed to precisely measure the integration between Learning Management Systems (LMS) and student character achievement (Nurdin et al., 2025; Zuraida & Setiawan, 2025). Finally, macro economic analyses regarding the influence of *pesantren* fintech on local MSME empowerment are required to measure the tangible contribution of digital *pesantren* to the wider community (Lutfiyah et al., 2024; Purnomo, 2025).

These findings imply the need to redefine leadership roles through transformative Digital Leadership. *Pesantren* leaders are now required to be not only moral-spiritual authorities but also innovation drivers capable of adopting technology without abandoning core values like sincerity and simplicity (Bahri & Najiburrahman, 2024; Yuliati A. S et al., 2024). Guardians need to integrate hybrid curricula that unite *kitab kuning* (classical texts) studies with interactive media through the "White Book" concept (Khoiriyah & Riyadi, 2023). In facing the digital "Third Space," practitioners are advised to provide a healthy digital ecosystem, such as Islamically filtered AI and neuroscience-based digital habituation to accelerate language mastery without losing traditional values, thus preventing deviant behavior in secret digital spaces resulting from total bans (Jailani, 2025; Nada-Qisthina & Musyafak, 2025; Zaini & Hamidah, 2023).

Managerially, implementing integrated governance systems such as Santrilink or cloud based One Stop Services (PTSP) is essential to strengthen public accountability, institutional professionalism, and information management digitalization. This aims to build a high-quality *pesantren* based education brand image that remains competitive in the global education ecosystem (Fauzi et al., 2025; Khoiroh et al., 2025; Qoyum, 2024). Another implication is the necessity of making digital literacy a mandatory curriculum, rather than a mere extracurricular activity, so that students possess the competence to preach moderately and compete healthily in the virtual world (Purnomo, 2025).

For the government, these findings emphasize the urgency of standardizing digital infrastructure to overcome technological disparities, especially in remote and 3T *pesantren* (Bali & Ramadani, 2025). Policies should be directed toward digital competence certification programs for *pesantren* teachers that remain sensitive to traditional values, and specific regulations regarding ethics and big data protection for students to guarantee privacy in boarding environments (Lutfiyah et al., 2024; Nurdin et al., 2025). The government can also encourage the *pesantren's* role in global agendas by providing incentives for institutions that successfully integrate Sustainable Development Goals (SDGs) into their learning innovations (Martanti et al., 2025; Zaini & Hamidah, 2023).

The transformation of *pesantren* in the modern era has given birth to the concept of "Digital Salafiyah," an evolution of hybrid pedagogy asserting that tradition and technology are no longer dichotomous. The validity of Islamic scholarly authority is now beginning to be recognized through digital media, where traditional methods like

Sorogan and *Bandongan* expand into the virtual realm without losing their essence to maintain the *sanad* (Khoiriyah & Riyadi, 2023; Suresman et al., 2025). This phenomenon marks the birth of Techno Religiosity, a condition where Artificial Intelligence (AI) acts as an "authority assistant" that accelerates access to Islamic law while remaining under the control of *pesantren* values (Bahri & Najiburrahman, 2024; Nada-Qisthina & Musyafak, 2025).

Managerially, *pesantren* have shifted from personal charismatic models toward integrated Technocratic Management, such as the use of Santrilink and PTSP to realize Good Governance (Fauzi et al., 2025; Qoyum, 2024). Furthermore, the integration of SDGs into the curriculum shows that *pesantren* are now strategic global partners aligning Industry 4.0 advancements with spirituality (Martanti et al., 2025; Zuraida & Setiawan, 2025). However, this transformation also brings theoretical challenges; recent findings confirm Everett Rogers' Diffusion of Innovations Theory, where the Kyai acts as a crucial early adopter, while also expanding Max Weber's traditional authority theory into "Digital Authority," where the Kyai's charisma transcends physical boundaries via social media (Bahri & Najiburrahman, 2024; Qoyum, 2024). Conversely, the moral surveillance contradictions in the digital "Third Space" trigger new ethical risks demanding a more comprehensive methodological and theological response from the *pesantren* community (Purnomo, 2025; Zaini & Hamidah, 2023).

4. Conclusion

Digital transformation in Islamic boarding schools today is no longer merely the adoption of technological tools, but rather a process of strategic hybridity that successfully bridges classical scholarly traditions with the modernity of Industry 4.0. Through a more transparent and accountable institutional management framework based on information systems (such as PTSP and Santrilink), Islamic boarding schools are able to enhance the effectiveness of their educational services without having to sever the roots of their spiritual identity. Traditional authority centered on the figure of the Kyai and the use of the Kitab Kuning remains the primary foundation, yet it is now expanding its reach through the concept of "Digital Leadership" and the simplification of instructional materials into adaptive digital "White Books" tailored to the needs of millennial students. On the other hand, this integration of technology has created a "Third Space" in social interaction, where students actively negotiate traditional norms with the realities of the virtual world.

Although demonstrating remarkable cultural resilience in positioning technology as a means (*wasilah*) to strengthen spiritual goals (*ghayah*), the implementation of digital *pesantren* still faces real challenges in the form of digital infrastructure gaps (especially in 3T regions) and limited technological competence among some senior educators. The current limitations of research, which remains confined to local case studies, open opportunities for future research agendas, particularly longitudinal studies on the impact of technology exposure on the validity of alumni's scholarly lineage (*sanad*), as well as ontological explorations regarding the status of generative AI within Islamic law from the perspective of Salafi *pesantren*. Overall, this paper affirms that digital *pesantren* represent a future model of Islamic education that is moderate and technologically literate, yet remains steadfast in preserving the dignity and scholarly lineage that has been passed down through generations.

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