DIGITAL TRANSFORMATION IN PESANTREN: IMPACTS AND CHALLENGES IN ISLAMIC EDUCATION

Ahmad Nabilul Maram[1], Zainal Fanani[2],

[1,2], Ilmu Al-Quran dan Tafsir, Universitas Islam Negeri Sunan Ampel, Indonesia
[3]Studi Islam, Universitas Islam Negeri Sunan Ampel, Indonesia
nabilul.maram@gmail.com [1] zainalfanani13597@gmail.com [2]

INFO ARTIKEL	ABSTRAK
	This study explores the impact of digitalization on teaching methods in pesantren, focusing on how digital integration drives the process of *deterritorialization*, or the shift from physical to virtual learning spaces. It specifically examines how traditional methods such as *halaqah*, *sorogan*, and *bandongan* are adapted into digital platforms to reach non-resident students and broader communities, while preserving pesantren's core traditional values. This research employs a qualitative case study approach. Data were gathered through in-depth interviews using an interview guide, non-participant observation, and documentation of digital learning materials. Thematic analysis was used to process the data, involving reduction, narrative presentation, and conclusion drawing. The findings indicate that digitalization has expanded access to religious education, enhanced student engagement, and extended the outreach of pesantren teachings, particularly through the use of internal applications, virtual forums, and synchronous-asynchronous learning platforms. However, pesantren also face persistent structural and cultural challenges, such as limited digital infrastructure, low digital literacy, and resistance to change among teachers and senior students. Nevertheless, this study affirms that selective digital integration can enhance the relevance of pesantren in the modern era, as long as it remains rooted in traditional values and the holistic principles of Islamic education.

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A. INTRODUCTION

Pesantren, as an Islamic educational institution deeply rooted in Indonesian societal traditions, has distinctive characteristics in teaching religious knowledge, particularly through classical teaching methods such as bandongan and sorogan (Alwi, 2016; Hidayatulloh et al., 2023). For a long time, this system has emphasized the importance of daily guidance for santri mukim (resident students), with direct interaction between the kiai (Islamic cleric) and the students in the process of reading and explaining the kitab kuning (classical Islamic texts), which is believed to foster a profound understanding of religious texts. However, globalization dynamics and the development of digital technology have triggered significant changes in the educational system, including within pesantren. With the increasing use of digital platforms for teaching and learning activities, pesantren face a major challenge in maintaining their traditional characteristics while adapting to the demands of the times.

In this context, the understanding of the concept of "deterritorialization" becomes relevant, especially for audiences outside the pesantren who wish to access religious materials online. The shift from physical to digital spaces enables broader access to Islamic education, including for those residing in remote areas (Darajat et al., 2022; Mutmainah, 2024). On the other hand, the use of digital media also brings various impacts on traditional teaching methods, ranging from the effectiveness of interactions, community formation, to the potential for creating broader and more innovative learning models (Prabowo, 2022).

In recent years, literature on digitalization in Islamic educational institutions has begun to grow, aligning with global trends emphasizing the

importance of digital literacy to enhance the competitiveness and relevance of educational institutions (Muiz, 2023). For example, the pesantren curriculum update that includes digital entrepreneurship subjects is expected to encourage students to develop independence and 21st-century skills. However, previous research has revealed that not all pesantren have adequate infrastructure or resources, causing a gap between institutions that can transition to online teaching models and those that cannot (Kholili, 2021). Furthermore, the digitalization process is also accompanied by concerns over the potential erosion of traditional values that define the pesantren's identity. Various studies indicate that efforts to introduce digital media often encounter issues such as low technological literacy, cultural resistance, and limited funding (Shofiyyah et al., 2019). On the other hand, many believe that digitalization can expand the dakwah (Islamic preaching) network, strengthen the synergy between the kiai and students, and enrich learning methods with diverse learning resources (Kuswana, 2023; Muhith, 2023).

In addressing the main research problem, the central focus lies in how far the adoption of digital media in pesantren affects traditional teaching methods. This adaptation process is crucial considering that the strength of pesantren lies in the personal interaction between the kiai and students. Previous studies show that although digital platforms such as Zoom and Google Meet can help maintain communication during the pandemic, questions remain regarding the effectiveness and depth of discussions created (Aunul & Handoko, 2022). Some argue that the use of online platforms may reduce the intensity of personal guidance that characterizes the sorogan method because students do not always receive direct corrections when reading the kitab kuning (Irvine, 2021). This presents a challenge in maintaining the quality of learning, especially in religious education that emphasizes manners (adab) and the instillation of values through intensive interaction.

Moreover, several studies highlight the need for common solutions to the challenges emerging in the digitalization process of pesantren, such as the provision of adequate technological infrastructure, digital literacy training for teachers and students, and the development of adaptive teaching models

(Syani et al., 2020). Considering that many pesantren are located in remote rural areas, the lack of stable internet access hinders the sustainability of online classes and reduces smooth communication between teachers and students (Fandir, 2024). On the other hand, digital literacy training is essential for kiai to optimally utilize digital media in delivering learning materials. Although this has been pursued in several pesantren, the scale of implementation is still limited and uneven across Indonesia. Financial solutions are also important because digital learning hardware and software require considerable costs, especially for pesantren that have long relied on community donations.

In pursuit of more specific solutions, some studies highlight the blended learning approach that combines face-to-face methods with online platforms. This model is believed to bridge the gap between traditional and modern methods while maintaining the communal and intimate character that is typical of pesantren education (Adedoyin & Soykan, 2020). Another increasingly popular approach is the integration of the Digital Competence framework to ensure that teachers and students master basic technology usage skills. According to (Sá et al., 2021). Strengthening digital competence not only involves mastery of hardware and software but also awareness of digital ethics, data protection, and critical thinking skills in responding to information circulating on the Internet. This is relevant for pesantren, which prioritize the formation of students' morals and character. In other words, this specific solution aligns with the spirit of preserving Islamic values while providing room for innovation in teaching methods.

Additionally, previous research indicates that the implementation of digital technology in pesantren can be directed toward enriching the curriculum, increasing students' learning motivation, and fostering more inclusive cross-boundary interactions (Irvine, 2021). For example, the use of social media, online classes, and interactive educational applications has been proven to increase student participation and eliminate geographical barriers in the learning process. Although it has not fully replaced the strength of physical interaction, this model offers attractive flexibility for those who need remote access, such as students with family

responsibilities and alumni who wish to continue learning. Furthermore, digital transformation also requires pesantren management to develop long-term funding strategies and targeted technology governance policies.

Based on the solutions that have been studied, it is evident that the literature emphasizes the importance of balancing digitalization efforts with preserving tradition. The literature highlights that pesantren need to determine the appropriate proportion of technology use to ensure the essence of education is maintained (Irvine, 2021; Syani et al., 2020). Herein lies the research gap: there is no comprehensive understanding of how pesantren can sustainably carry out this deterritorialization process while maintaining manners, hierarchy, and emotional relationships between the kiai and students. Several adaptation models have been proposed, but few studies have analyzed their long-term implications, especially in remote areas with limited technology access (Fandir, 2024). This fact opens further research opportunities to formulate approaches relevant to pesantren's characteristics in various socio-cultural situations.

Therefore, this study aims to analyze the deterritorialization process in pesantren through digital media and its impact on traditional teaching methods. The novelty of this research lies in its attempt to integrate the concept of deterritorialization—which emphasizes the changing role of physical space in education—with analyses of digital literacy, curriculum development, and technology governance policies. This study focuses on how the core values of pesantren, such as character building, emotional closeness between kiai and students, and the study of the kitab kuning, can be maintained even when using digital platforms. Moreover, the study covers various inhibiting and supporting factors in implementing technology in pesantren environments, including technical, cultural, economic aspects, and stakeholder support. Through comprehensive and field-based analysis, it is hoped that the findings of this research can provide concrete recommendations on relevant, effective, and tradition-aligned digitalization strategies for pesantren.

B. METHODS

This study employs a qualitative approach with a case study method to understand the deterritorialization process of pesantren by utilizing digital media within its original context (Ilmani, 2023; Utari, 2024). This approach was chosen because it allows for an in-depth exploration of the complex details of technology adaptation in pesantren environments. The research subjects include pesantren administrators, teachers, and students who have actively participated in implementing digital programs. Table 1 summarizes the criteria for selecting research participants to clarify the selection process.

Data collection was conducted through in-depth interviews to uncover the perceptions and experiences of informants, non-participatory observations to capture factual interactions in the field, and document studies of pesantren policies, activity reports, and digital learning materials (Baxter & Jack, 2015). The instruments used in this study included an interview guide to structure the in-depth interviews, an observation sheet to record field interactions systematically, and a documentation format to organize and analyze relevant institutional documents. Data triangulation was applied by combining findings from various sources to enhance the validity of the research results (Anggara, 2023). Data analysis was carried out step-by-step by reducing relevant information, presenting it narratively, and drawing conclusions based on emerging patterns and themes (Miles et al., 2014). This process ensures that each piece of data is systematically analyzed, resulting in a comprehensive understanding of the impact of digital transformation on traditional teaching methods.

To maintain the validity of the findings, this study incorporates member checking, which involves verifying the interpretation of interview results with respondents. It applies an audit trail in the form of detailed documentation of all research stages. To complement the data verification process, all research steps were recorded in a daily field journal to ensure consistency. Therefore, this study is expected to provide a comprehensive understanding of pesantren's efforts to integrate technology while preserving the core values of Islamic education.

Participant Group	Criteria
Administrators	1. Involved in digitalization policy formulation 2. Holds access to managerial decision-making
Teachers	1. Experienced in using digital media in teaching 2. Regularly teaches kitab kuning
Students	1. Actively participates in online activities 2. Comes from diverse backgrounds (class/educational level)

C. RESULTS AND DISCUSSION

1. Deterritorialization of Pesantren and Transformation of Teaching Methods

The process of deterritorialization in pesantren signifies a significant shift in classical teaching methods that have long been the hallmark of traditional Islamic education (Alwi, 2016; Hidayatulloh et al., 2023). Driven by the rapid development of digital technology, these educational institutions have begun utilizing various online platforms to accommodate distance learning. Simultaneously, there is a strong desire to maintain the essence of interaction that forms the fundamental basis of halaqah, sorogan, and bandongan methods. The concept of deterritorialization in this context refers to the elimination of geographical and conventional physical boundaries, enabling religious teaching processes to occur in multiple locations simultaneously. The integration of technologies such as Zoom or Google Meet is expected to expand the participation of students spread across various regions, including remote areas, while still allowing for intensive dialogue between teachers and students (Darajat et al., 2022; Mutmainah, 2024). However, using these digital platforms is generally prioritized for alumni or non-resident students who need flexible access. At the same time, face-to-face methods remain the backbone for santri mukim (resident students). Adopting digital media requires comprehensive adaptation, from infrastructure readiness to curriculum adjustments and classical methods.

Halaqah, which typically emphasizes open discussions in small groups, has now been adapted into online formats through video conference sessions. The use of software such as Zoom and Google Meet facilitates interactive communication among participants, even when they are in different locations (Wahyudi, 2023). Discussions that previously took place face-to-face on the pesantren veranda or classrooms can now be conducted in virtual spaces that allow participants to express their opinions in turns. This innovation is strengthened by the arrangement of breakout rooms for sub-discussions, ensuring that the deep discourse characteristic of halaqah remains intact. Teachers usually divide the material into several segments and then provide opportunities for students to ask questions, give responses, or offer interpretations related to the kitab discussion (Aunul & Handoko, 2022). However, the success of this online learning depends greatly on the quality of the internet network, the participants' level of digital literacy, and the teacher's ability to moderate discussions without diminishing the familial atmosphere inherent in halaqah (Irvine, 2021).

Sorogan, a method that emphasizes personal guidance through direct correction of kitab readings, has also undergone significant transformation in the digitalization framework. Online sorogan adjustments are usually made by having students send audio or video recordings of their readings to teachers, who then provide written notes or voice messages as feedback (Supriyono, 2022). In certain situations, teachers and students can meet virtually in one-on-one video conference sessions to maintain the personal aspect (Muiz, 2023). Challenges arise when many pesantren lack adequate technological support, while some teachers still struggle to master digital devices (Shofiyyah et al., 2019). Dependence on reliable internet connections limits the correction process to students who have sufficient access (Fandir, 2024). Furthermore, not all teachers feel comfortable providing detailed corrections without face-to-face interaction, as this can reduce the emotional closeness between teacher and student, which is crucial in Islamic education.

Bandongan, which focuses on lectures or explanations of the kitab kuning in front of

groups of students, has also been adapted with the use of digital platforms. Pesantren adopting this approach typically schedule regular virtual lectures, where kiai or ustadz read and explain texts attended by students online (Zafi et al., 2021). Some teachers record these explanations and upload them to video platforms like YouTube, allowing students to access them asynchronously (Rahman & Asrohah, 2022). This approach has two advantages: first, flexible learning times for students; second, the potential to broaden the reach of dakwah to a wider audience (Aunul & Handoko, 2022). However, online bandongan faces challenges in maintaining the intimacy of discussions and directly assessing students' understanding (Rouf, 2024). In face-to-face teaching, the kiai can immediately assess students' comprehension through verbal and non-verbal responses, whereas in virtual classes, this process requires additional mechanisms, such as Q&A sessions or interactive quizzes.

The overall use of digital tools creates learning flexibility that was previously unimaginable. Zoom, Google Meet, and Islamic-based educational applications help integrate conventional methods with the advantages of modern technology. Additionally, WhatsApp and Telegram often serve as daily communication media, where teachers share announcements, schedules, and learning material links (Aprilisa & Kartowagiran, 2022). Some pesantren have begun developing internal applications to manage attendance, assignments, and student assessments (Table 2). This simplifies information synchronization and facilitates individual learning guidance beyond formal class hours. In the context of time and space limitations, the use of online platforms also allows kiai to interact with students across regions, reducing the educational gap between central and peripheral areas (Muhith, 2023). However, literature emphasizes the need for continuous training for teachers and staff, as low digital literacy can hinder the optimal use of these tools (Fadli & Dwiningrum, 2021).

In developing digital media adaptation, some pesantren implement innovations to maintain the Islamic educational character that emphasizes adab (manners) and close relationships. Teachers often begin online sessions with collective prayers, shalawat recitations, or brief advice highlighting the manners of seeking knowledge, as done in face-to-face sessions (Kuswana, 2023). Thus, digital methods do not merely replace the old system but also complement and enrich the learning process. Moreover, successfully adapted pesantren tend to show increased student motivation, as they experience new interactive learning methods, including online quizzes, instructional videos, and virtual discussion forums (Dečman et al., 2022). However, some studies warn that the absence of comprehensive guidelines may lead to shifting priorities, where religious materials are sidelined by the technology itself (Kuswana, 2023; Shofiyyah et al., 2019).

Integrating digital tools to enhance learning access also demands the development of basic infrastructure. Pesantren in rural areas often face slow or unstable internet connections, disrupting online classes. Addressing this issue requires not only technical solutions, such as high-speed internet installation, but also government policy support or partnerships with telecommunications service providers (Aunul & Handoko, 2022; Irvine, 2021). Some initiatives provide internet quota subsidies for underprivileged students, but their scale remains limited. Financial factors become a significant obstacle because procuring hardware and operational costs for digital platforms require substantial funds (Shofiyyah et al., 2019). Nonetheless, pesantren that successfully establish partnerships with local philanthropies or international donors can develop mini computer labs and conduct digital training for teachers (Fandir, 2024).

The use of educational applications, particularly those focused on kitab kuning learning, has become essential in transforming teaching methods in pesantren. Some local developers have introduced software-based solutions designed to digitize kitab manuscripts, complement lectures with interactive notes, and implement online evaluation systems (Wahyudi, 2023). This has a positive impact on increasing students' interest, especially the younger generation, who are more familiar with technology. Educational applications also reduce

geographical barriers since students can access learning materials anytime, even after formal class hours (Darajat et al., 2022). However, the optimal use of educational applications still depends on the teacher's ability to utilize the available features. This transition process requires technical support and intensive assistance for teachers who are not yet accustomed to them.

Table 2. Internal Applications Used in Pesantren

Application Type	Main Features
Attendance & Assignments	1. Manage attendance 2. Assignment & grading
Digital Kitab Management	1. Access to app-based kitab kuning 2. Interactive note-taking
Internal Discussion Forum	1. Exclusive virtual classes 2. Community discussion space

2. Challenges in the Implementation of Digital Media

The implementation of digital media in pesantren across Indonesia still faces various structural and cultural challenges that affect its effectiveness and sustainability (Syani et al., 2020). Although there is an urgency to catch up with technological advancements to ensure the relevance of Islamic educational institutions in the modern era, both technical and non-technical obstacles often slow down this process. Most of these challenges stem from low digital literacy among teachers and students, inadequate infrastructure, and minimal financial support. Additionally, resistance to change frequently arises because digitalization efforts are perceived as innovations that may shift the traditional identity of pesantren. This situation becomes more complicated when discussing the access gap in remote areas, where internet networks are often inadequate or even entirely unavailable (Kaur et al., 2019).

Digital literacy is a fundamental factor determining the successful use of technology in learning (Sá et al., 2021). However, many pesantren educators are not yet accustomed to digital platforms, making the transition to online teaching suboptimal (Kholili, 2021). Students face similar problems, especially those with only basic computer skills, which hinder them from accessing learning applications, downloading online materials, or attending video conference sessions (Fandir, 2024). The lack of intensive training and mentoring causes technology implementation to often stop at the conceptual level without being accompanied by adequate practice. This impacts the low motivation of pesantren stakeholders to utilize technological innovations sustainably. For some kiai, technological complexity not only demands adjustments in teaching methods but also requires a mindset shift to be willing to learn and implement more participatory new methods, whereas traditional practices place the kiai as the sole source of knowledge (Aunul & Handoko, 2022).

Infrastructure limitations are another significant factor hindering digital transformation. Not all pesantren have stable internet access or sufficient hardware to support online learning activities (Krakowiak-Bal et al., 2017). In several rural areas, telecommunications signals are still very weak, making it difficult for students to download materials or join video conference sessions (Muhith, 2023). For students living in dormitories with minimal facilities, this problem is even more pronounced as they lack adequate laptops or smartphones. Although in some cases, pesantren attempt to provide computer laboratories, the limited number of devices makes online learning inaccessible to all students (Rouf, 2024). Additionally, equipment maintenance costs and internet subscription fees exceed the average pesantren budget, especially for institutions that rely on donations or community contributions (see Table 3). Thus, while the motivation for digitalization exists, the ability to realize technical factors beyond the control of teachers or students often hinder it.

The financial aspect cannot be separated from infrastructure limitations. To modernize technology, pesantren require significant funds, especially for hardware procurement, internet bandwidth upgrades, and technical training for teachers (Mainuddin, 2024). Some urban pesantren may have better sponsor or donor partnerships, but rural pesantren often struggle to raise adequate funds (Lundeto et al., 2021). This leads to a widening gap where pesantren that can invest in digital infrastructure transition

more easily to online learning, while those in underdeveloped areas struggle to keep up with technological developments (Xu, 2016). Collaborative efforts with private sectors or government agencies have been initiated, but have not been evenly distributed across all regions, leaving many pesantren unable to benefit (Yuningsih, 2023).

Beyond technical aspects, resistance to change becomes a cultural challenge commonly encountered when technology is introduced in pesantren environments (Kuswana, 2023). For some, especially senior kiai, the purity of traditional teaching methods is non-negotiable. Concerns that digitalization will tarnish the authenticity of teacher-student interactions often lead to skepticism. The sorogan method, for instance, is considered difficult to replace with online platforms because the correction of kitab kuning readings must be done face-to-face to maintain the originality of teachings and emotional closeness (Irvine, 2021). Similarly, virtual halaqah is seen as less profound because open discussions supported by nonverbal context are difficult to fully replicate in digital spaces (Syani et al., 2020). In this context, curriculum updates or the use of Islamic-based educational applications need to be gradually socialized so stakeholders can accept technology as a complementary tool rather than a total replacement for traditional methods (Douthit et al., 2015).

Apart from resistance among teachers, digital cultural limitations also appear in the mindset of some students who are more comfortable with conventional learning activities, such as taking notes in a kitab and listening to live lectures in assemblies (Kholili, 2021). Without balanced socialization and mentoring, digitalization will only feel like an additional burden that disrupts their routines (Douthit et al., 2015). This is especially true for senior students who have been accustomed to face-to-face learning models for a long time. Insufficient socialization also causes misunderstandings about the real benefits of online platforms, which should enhance learning efficiency and quality.

The access gap in remote areas further complicates digitalization efforts. Remote regions are often not covered by proper internet networks, implementing video conferencing platforms or educational applications ineffective (Fandir, 2024). Students in these locations must travel long distances to access reliable connections, such as internet cafes or sub-district centers with better signals (Kaur et al., 2019). Moreover, the presence of sophisticated smartphones is not evenly distributed due to economic factors and local community preferences (Krakowiak-Bal et al., 2017). This situation results in unequal learning quality, as urban students benefit from sufficient technology access. At the same time, those in remote areas rely solely on traditional methods or, at best, basic mobile phones.

The pesantren education system, which emphasizes in-depth study of religious texts through direct interaction between kiai and students, adds complexity to digitalization (Muhith, 2023). On one hand, technological transformation can open more opportunities for students to access learning resources and engage with religious scholars in various locations. On the other hand, some argue that spiritual and character development aspects cannot be fully delivered through technology, as adab values are often transferred through the kiai's exemplary behavior in physical environments (Shofiyyah et al., 2019). The kiai serves as a teacher and a moral role model whose presence is integrated into the students' daily lives. The absence of physical teachers in online settings is said to risk diminishing the cultivation of spiritual aspects, potentially eroding sincere learning, and students' mental development (Irvine, 2021).

Financial constraints, cultural resistance, and infrastructure gaps do not mean that digitalization efforts in pesantren are entirely stalled. On the contrary, various initiatives have begun to bridge these gaps, such as digital literacy training programs designed explicitly for kiai and teachers (Kuswana, 2023). Some pesantren have also collaborated with technology companies to conduct teacher training, build computer laboratories, or provide specialized software for kitab learning. Although these initiatives have not yet covered all regions, they at least demonstrate that technological transformation can be

accelerated when systematically supported by stakeholders, including donors, the government, and the wider community (Yuningsih, 2023). Digital scholarship schemes for outstanding students have also been initiated, where sponsors provide laptops or smartphones to ensure that a lack of resources does not hinder students.

Table 3. Financial Constraints in Pesantren Digitalization

3. Positive Impacts and Practical Implications

The growing digitalization in pesantren has provided various tangible benefits, particularly in increasing student participation and expanding the reach of dakwah (Islamic preaching) (Aunul & Handoko, 2022). As various online platforms such as Zoom, Google Meet, and specialized educational applications are adopted, students who previously struggled to access learning can now attend classes more flexibly. Teaching methods that combine virtual lectures, Q&A forums, and online assignments enable interactive engagement, motivating students to be more involved in the learning process (Irvine, 2021). For students living far from pesantren, internet use facilitates regular contact with teachers, minimizes geographical barriers, and strengthens the learning community relationship. Additionally, digital access triggers increased student activity in seeking alternative learning resources, such as referring to trusted Islamic websites or audio-visual content that enriches their understanding of kitab material.

In addition to expanding access for local students, digitalization has significantly impacted the pesantren's dakwah outreach, which can now transcend national boundaries (Mutmainah, 2024). Live broadcasts of religious activities, recorded lectures on YouTube channels, and online discussions invite participation from communities across regions. Those who have never received formal pesantren education can experience the atmosphere of kitab kuning learning, study fiqh principles, or delve into the thoughts of classical scholars. Various social media platforms allow kiai and ustadz to disseminate sermons more easily, answer questions from internet users, and build broader

interactions with a more diverse community (Darajat et al., 2022). This positive impact illustrates that digitalization can enhance the pesantren's image as an inclusive center of Islamic scholarship that is open to modern advancements (Kuswana, 2023).

For the students themselves, the ease of accessing online materials encourages a higher degree of independent learning. In traditional

Constraint	Description
Hardware Costs	Procurement of laptops, PCs, and smartphones for teachers & students
Internet Subscription	Regular monthly/annual expenses for stable internet connections
Training & Mentoring	Digital literacy training for educators, including speaker fees and materials
Equipment Maintenance	Repairs, upgrades, and regular hardware maintenance

models, students rely on face-to-face meetings with kiai as the primary source of knowledge. However, with the presence of digital kitab collections, religious lecture videos, and Islamic infographics, learning can be done independently and repeatedly (Shofiyyah et al., 2019). When encountering difficulties, students can use virtual discussion forums to ask questions or seek other references without having to wait for face-to-face halaqah sessions (Rouf, 2024). This pattern fosters a generation of more adaptive students, responsive to technological advances, and equipped with 21st-century skills necessary in the global era. Improved digital literacy also opens opportunities for students to engage in technology-based entrepreneurship activities, such as selling local products online or using social media platforms for social and charitable campaigns (Prabowo, 2022).

Regarding practical implications, the initial recommended step is to improve digital literacy within pesantren through systematic training for teachers. Such initiatives have been implemented by several pesantren in collaboration with NGOs or technology companies to conduct workshops on using online platforms (Sá et al., 2021). The training focuses not only on software usage but also on relevant pedagogical strategies, such as creating interactive modules, using multimedia, and online assessment techniques. This effort is crucial to ensure that every teacher has basic

competencies, can produce quality digital content, and understands responsible media ethics (Kholili, 2021). By equipping teachers, it is expected that students will also receive proper guidance in using technology as a learning and personal development tool.

Furthermore, collaboration with technology providers needs to be strengthened to improve the efficiency and sustainability of digital programs in pesantren (Nikmatullah et al., 2023). Some internet service providers or educational platforms are willing to partner to expand their market while contributing socially. They can help provide subsidized internet quotas, affordable hardware, or specialized learning platforms tailored to pesantren curricula (Lundeto et al., 2021). This effort is crucial for pesantren still struggling with funding, allowing them to leverage external resources to optimize digital transformation. Additionally, this partnership can include expert exchanges, where teams from technology companies provide intensive guidance on technical application usage and technology management at the institutional level (Fandir, 2024). As a result, pesantren will be better prepared to manage infrastructure independently in the long term.

To ensure safety and efficiency, well-structured governance policies are needed both at the internal pesantren level and at the regional government level. Internally, pesantren administrators need to formulate rules regarding mobile device usage, internet access times, and student data protection (Syani et al., 2020). Clear regulations will ensure that even with integrated technology, core Islamic educational values such as discipline and adab are preserved. On the other hand, government regulations can address aspects such as internet availability in remote areas, tax incentives for companies donating technology to pesantren, and monitoring digital content that supports religious moderation (Irvine, 2021). With layered policies, the Islamic education ecosystem can develop digitally without neglecting Islamic norms and local community needs.

A well-established policy must also be accompanied by continuous efforts to maintain implementation quality. Regular evaluations, for example, every semester, can monitor the effectiveness of online platform usage in classrooms, assess existing challenges, and identify improvement areas (Rouf, 2024). If technical obstacles arise due to internet network limitations, pesantren management can immediately seek alternative providers or negotiate quotas with service providers. If digital literacy issues emerge among teachers, plans for advanced training or more intensive mentoring can be scheduled. Through comprehensive evaluation, administrators and teachers can formulate adaptation strategies for both religious and general subjects, optimizing digitalization's role.

Targeted digitalization also has the potential to create inter-pesantren networks, where knowledge exchange, learning models, and kitab kuning teaching occur across regions (Darajat et al., 2022). Virtual forums or discussion groups for kiai and ustadz from various areas will enrich perspectives and accelerate innovation processes. Pesantren already advanced in technology adoption can share best practices, including handling digital literacy challenges, module development, and evaluation system design (Kuswana, 2023). Such partnerships make the national pesantren ecosystem more equitable in educational quality, as each institution learns from and contributes to one another.

Another positive impact worth appreciating is the transformation of the pesantren's image in the broader community. Previously, some circles perceived pesantren as less responsive to technological developments. However, with increasing technological adaptation, this perspective is shifting, and pesantren are now seen as dynamic and innovative institutions (Muhith, 2023). The readiness to deliver digital learning amid global changes shows that pesantren can embrace modernity without abandoning Islamic identity. Students accustomed to using technology for learning will adapt more easily when entering an increasingly digital society (Fadli & Dwiningrum, 2021). Through this approach, Pesantren graduates will have a strong religious foundation and relevant technological competencies for professional life.

Over time, several pesantren have begun integrating digitalization into extracurricular activities, such as forming coding clubs or online-based entrepreneurship initiatives (Prabowo, 2022). These initiatives provide practical experiences for students to hone creativity and foster entrepreneurship aligned with Islamic values. Through this process, pesantren have the potential to become social innovation laboratories, where students actively produce religious-themed digital content, run environmental campaigns, or engage in online philanthropy movements. This advances academic aspects and builds young Muslims' critical awareness and social responsibility.

In terms of human resource development, digital transformation also offers opportunities for pesantren administrative staff to enhance their skills in online management (Lundeto et al., 2021). Digitalizing finances, managing student data, and publishing dakwah activities online will require new skills. If appropriately managed, capacity building will improve the institution's professionalism, streamline external collaboration, and strengthen global networks. Pesantren adopting online management systems are generally more efficient in tracking attendance, reporting learning achievements, and communicating program progress to the public (Sá et al., 2021).

The positive impacts of digitalization on pesantren are diverse, covering academic, social, and managerial dimensions. Despite ongoing challenges in digital literacy, infrastructure, and cultural resistance, technology integration in pesantren sparks optimism for developing a more inclusive Islamic educational ecosystem. Through strengthening digital literacy, sustainable collaboration, and governance policies, pesantren can maintain their core mission while adapting to global demands.

D. CONCLUSIONS AND SUGGESTIONS

This study concludes that digitalization in pesantren—particularly through the adaptation of traditional methods such as halaqah, sorogan, and bandongan into online formats—has expanded access to religious education, fostered higher student engagement, and broadened the pesantren's educational outreach. Based on field observations, students demonstrated increased motivation in online sessions, pesantren initiated internal educational applications for kitab learning and assignments, and participation in virtual discussion forums became more consistent. These developments illustrate how pesantren have actively negotiated between tradition and technological change.

Despite challenges such as inadequate infrastructure, low levels of digital literacy, and cultural resistance among stakeholders, the findings indicate that pesantren can sustain their religious and pedagogical identity while innovating through selective and adaptive technology. To ensure long-term effectiveness, the study recommends enhancing teachers' digital competencies, establishing comprehensive governance systems, and cultivating partnerships with technology providers and policymakers.

This study contributes to the growing literature on digital transformation in Islamic education by offering an empirically grounded analysis of pesantren's deterritorialization process. It underscores the importance of aligning digital strategies with traditional educational values to maintain institutional integrity while responding to contemporary demands.

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