



**Adapting Artificial Intelligence in *Pesantren*: Institutional Typologies, *Kyai* Leadership, and Adaptive Optimism**

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**Abstract**

This study aims to explore the integration of artificial intelligence (AI) in Islamic boarding school (*pesantren*) education. This study uses a literature review method. Data sources include journal articles, academic books, and official documents, such as Law No. 18 of 2019 concerning *Pesantren*. The results show that Islamic boarding schools have long adapted new technologies to improve the quality of education and management while maintaining their values and traditions. This is evident in various aspects such as the use of online learning platforms, the use of digital Al-Qur'an and *Maktabah Syamilah* applications, digital information and administration systems, the use of Islamic boarding school websites and social media for promotional and da'wah purposes with interactive content to reach a wider audience, and training for Islamic students (*santri*) on digital literacy and AI-based edutechnopreneurship. These conditions strengthen the role of *pesantren* in shaping a generation that is academically competent, technologically literate, has character, has social awareness, is independent, and can face the challenges of the world of work in the new technological era. Overall, this study shows that *pesantrens* are able to adapt without losing their identity, values, and traditions in integrating technology. This study contributes to enriching Islamic education studies by providing a conceptual mapping of the integration of new technologies, including AI, in the context of Islamic boarding schools, an area that remains relatively underexplored.

**Keywords:** Artificial Intelligence; *Pesantren* Education; *Pesantren* Tradition.

**Abstrak**

Penelitian ini bertujuan untuk mengeksplorasi integrasi kecerdasan buatan (AI) dalam pendidikan pesantren. Penelitian ini menggunakan metode tinjauan pustaka. Sumber data meliputi artikel jurnal, buku akademik, dan dokumen resmi, seperti Undang-Undang No. 18 Tahun 2019 tentang Pesantren. Hasil penelitian menunjukkan bahwa pesantren telah lama mengadaptasi teknologi baru untuk meningkatkan kualitas pendidikan dan manajemen sambil tetap mempertahankan nilai-nilai dan tradisi mereka. Hal ini terlibat dalam berbagai aspek seperti penggunaan platform pembelajaran daring, penggunaan aplikasi Al-Qur'an dan Maktabah Syamilah digital, sistem informasi dan administrasi digital, penggunaan situs web pesantren dan media sosial untuk tujuan promosi dan dakwah dengan konten interaktif untuk menjangkau khalayak yang lebih luas, dan pelatihan bagi santri tentang literasi digital dan edutechnopreneurship berbasis AI. Kondisi ini memperkuat peran pesantren dalam membentuk generasi yang kompeten secara akademis, melek teknologi, berkarakter, sadar sosial, mandiri, dan mampu menghadapi tantangan dunia kerja di era teknologi baru. Secara keseluruhan, penelitian ini menunjukkan bahwa pesantren mampu beradaptasi tanpa kehilangan identitas, nilai-nilai, dan tradisi mereka dalam mengintegrasikan teknologi. Penelitian ini berkontribusi untuk memperkaya studi pendidikan Islam dengan menyediakan pemetaan konseptual tentang integrasi teknologi baru, termasuk AI, dalam konteks pesantren, suatu bidang yang masih relatif kurang dieksplorasi.

**Kata Kunci:** Kecerdasan Buatan; Pendidikan Pesantren; Tradisi Pesantren.

## INTRODUCTION

Islamic boarding schools (*pesantren*) are among the oldest Islamic educational institutions in Indonesia, playing a strategic role in shaping character and Islamic values within society.<sup>1</sup> With their distinctive lifestyles grounded in traditional values, *pesantren* have not only survived the changing times but also become agents of social transformation for their surrounding communities.<sup>2</sup> Their ability to influence the community's mindset, attitudes, and behavior without losing their identity makes them a cultural force that remains relevant today.<sup>3</sup> In this context, *pesantren* function not only as religious educational institutions but also as centers for character formation and cultural identity.<sup>4</sup> Through a holistic educational system, *pesantrens* teach religious, ethical, and cultural values that strengthen social bonds within society.<sup>5</sup>

They also play a crucial role in maintaining diversity and tolerance among religious communities amidst the challenges of pluralism in Indonesian society.<sup>6</sup> They also adapt to changing times without sacrificing Islamic principles.<sup>7</sup> In this increasingly connected era of globalization, *pesantren* can filter information and technological developments while maintaining their traditional values in shaping individual character.<sup>8</sup> This makes *pesantren* a relevant institution for addressing the challenges of modernity, including education grounded in pluralism and multiculturalism.<sup>9</sup> *Pesantren* also functions as an agent of change that can encourage society to appreciate diversity more, maintain tolerance among themselves, and maintain unity amidst differences, as stated by Gus Dur, who said that *pesantren* are a strong cultural fortress with an extraordinary ability to survive and adapt without losing their identity.<sup>10</sup>

In the era of artificial intelligence (AI), *pesantren* face new challenges that demand adaptability.<sup>11</sup> AI technology offers significant opportunities, from improving management efficiency to enhancing learning quality. However, *pesantren* still possess a unique advantage that

<sup>1</sup> Indah Herningrum, Muhammad Alfian, and Pristian Hadi Putra, "Peran Pesantren sebagai Salah Satu Lembaga Pendidikan Islam," *Islamika: Jurnal Ilmu-Ilmu Keislaman* 20, no. 02 (April 2021): 2, <https://doi.org/10.32939/islamika.v20i02.582>.

<sup>2</sup> Siti Yumnah, "Relevansi Nilai-Nilai Kearifan Lokal dalam Pembentukan Karakter Santri yang Moderat," 1, vol. 7 (2023): 429, <https://doi.org/10.36835/ancoms.v7i1.513>.

<sup>3</sup> Erna Wirayanti, "Metode Pendidikan Tradisional Pesantren dalam Membina Akhlak Santri (Studi Pesantren Nahdlatul Ulum Kabupaten Maros)," *Socius: Jurnal Penelitian Ilmu-Ilmu Sosial*, ahead of print, October 7, 2024, 427, <https://doi.org/10.5281/ZENODO.13896925>.

<sup>4</sup> Hosaini et al., "Tawheed-Based Pedagogy: Empowering Islamic Education Through Community Engagement And Pesantren Tradition," *Journal of Human and Education* 4, no. 4 (2024): 2, <https://www.jahe.or.id/index.php/jahe/article/view/1220/639>.

<sup>5</sup> Ade Zuki Damanik et al., "Peran Pondok Pesantren Kebudayaan dalam Menjawab Fenomena Krisis Identitas Budaya," *Aspirasi: Publikasi Hasil Pengabdian dan Kegiatan Masyarakat* 2, no. 5 (2024): 111, <https://doi.org/10.61132/aspirasi.v2i5.1029>.

<sup>6</sup> Azmatul Kholila, "Peran Sentral Pesantren dalam Membangun Moderasi Beragama dan Kerukunan Sosial di Indonesia: Tantangan dan Strategi Implementasi Nilai-Nilai Moderasi," 1, vol. 3 (2024): 174, <https://www.j-las.lemkomindo.org/index.php/BCoPJ-LAS/article/view/742>.

<sup>7</sup> Deddi Fasmadhy Satiadharmanto and Zayad Abd. Rahman, "Transformasi Literasi Dalam Pesantren; Perspektif Pemikiran Islam Di Pesantren Al Mu'min Muhammadiyah Tembarak Temanggung," *Jurnal IHSAN Jurnal Pendidikan Islam* 2, no. 2 (July 2024): 204, <https://doi.org/10.61104/ihsan.v2i2.172>.

<sup>8</sup> Ridwan Maulana Rifqi Muzakky, Rijaal Mahmud, and Andhita Risiko Faristiana, "Transformasi Pesantren Menghadapi Era Revolusi Digital 4.0," *ALADALAH: Jurnal Politik, Sosial, Hukum dan Humaniora* 1, no. 3 (June 2023): 249, <https://doi.org/10.59246/aladalah.v1i3.371>.

<sup>9</sup> Mukhamat Saini, "Pesantren dalam Era Digital: Antara Tradisi dan Transformasi," *Tasamuh: Jurnal Studi Islam* 16, no. 2 (October 2024): 348, <https://doi.org/10.47945/tasamuh.v16i2.1600>.

<sup>10</sup> A. Muhaimin Iskandar, *Melanjutkan Pemikiran & Perjuangan Gus Dur*, 1st ed. (Yogyakarta: PT. LKiS Printing Cemerlang, 2010), 64.

<sup>11</sup> Dwi Noviani and Muslim Ansori, "Pendidikan Islam di Era Digital: Tantangan dan Peluang," *Jurnal Lingkaran Pembelajaran Inovatif* 5, no. 11 (2024): 15, <https://oaj.jurnalhst.com/index.php/jlpi/article/view/5531>.

technology cannot replace: their role in instilling morality, ethics, and spiritual values. By combining strong traditions with the wise use of technology, *pesantren* can create a generation that not only masters technology but also possesses strong character and a humanitarian vision. The future of *pesantren* in the AI era depends on their ability to integrate and adapt the noble traditions that have been passed down for centuries.

Research on *pesantren* in the AI era shows a significant transformation in how they integrate technology into education and management. One example is the use of AI to support Quran memorization.<sup>12</sup> AI is also used in smarter evaluation and monitoring systems, such as tracking students' academic progress and managing attendance through facial recognition technology.<sup>13</sup> Several studies also discuss how *pesantren* can adapt AI technology to improve educational management and community-based learning. *Pesantren plays* a role in teaching religious, social, and cultural values. Still, in this AI era, they are also beginning to integrate technology-based learning to help students adapt to changing times.<sup>14</sup> Therefore, this study aims to explore the role of *pesantren* in maintaining their identity in the AI era and to determine how to utilize it without losing their traditional values.

## METHODS

This study uses a descriptive, qualitative approach, supported by a literature review, to examine the integration of AI technology into *pesantren* education and management.<sup>15</sup> Data sources were obtained from various relevant literature, including journal articles, academic books, and official documents such as the *Pesantren Law No. 18 of 2019*, which concerns *pesantren* and AI. The collected data were then analyzed using thematic analysis techniques to identify key themes related to AI implementation in *pesantren*, challenges, and potential adaptations. The analysis phase consisted of grouping, coding, and interpreting data to identify key recurring themes, map the application of AI in *pesantren*, identify challenges, and explore potential adaptations and integrations aligned with *pesantren's* values, traditions, and educational goals. This approach enabled the research to develop an analytical framework for the opportunities and limitations of AI-based digital transformation in *pesantren*.

## RESULTS AND DISCUSSION

### The Use of AI Technology in *Pesantren*

The use of AI technology in *pesantren* has become a key focus in understanding the transformation of Islamic education. Several *pesantren* in Indonesia have begun adopting it. This

<sup>12</sup> Basheer Adnan, "Leveraging Artificial Intelligence Technologies in the Service of the Holy Quran and Its Sciences," *Khazanah Journal of Religion and Technology* 2, no. 2 (2024): 36–44, <https://doi.org/10.15575/kjrt.v2i2.900>; Saeed Ibrahim Al-Namarnah et al., "Integrating Technology and Tradition: The Importance of Artificial Intelligence in Enhancing Quranic Memorization," *QURANICA - International Journal of Quranic Research* 17, no. 2 (September 2025): 304–24, <https://doi.org/10.22452/quranica.vol17no2.12>.

<sup>13</sup> Ahmad Sodik, "Peran Kecerdasan Buatan (Artificial Intelligence) dalam Mendorong Inovasi Manajemen Pendidikan Islam di Era Revolusi Industri 4.0," *An Naba* 7, no. 1 (May 2024): 9–18, <https://doi.org/10.51614/annaba.v7i1.388>.

<sup>14</sup> Muhammad Najihul Huda et al., "Pesantren Technology-Friendly: Enhancing Learning Effectiveness in The Modern Era," *Nadwa: Jurnal Pendidikan Islam* 19, no. 1 (July 2025): 1–22, 2025, <https://doi.org/10.21580/nw.2025.19.1.26173>; Murdianto Murdianto, "Balancing Traditional Values and Innovation in Pesantren Education in Lombok," *Edukasi Islami: Jurnal Pendidikan Islam* 12, no. 04 (August 2023), <https://doi.org/10.30868/ei.v12i04.7519>.

<sup>15</sup> Mark A. Earley, "A Synthesis of the Literature on Research Methods Education," *Teaching in Higher Education* 19, no. 3 (April 2014): 242–53, <https://doi.org/10.1080/13562517.2013.860105>.

reflects the potential of *pesantren* to use AI to disseminate Islamic preaching and religious education more broadly.<sup>16</sup> This adoption aims to ensure that students possess not only religious knowledge but also skills relevant to the needs of their time. The availability of digital training and an introduction to AI can expand students' access to develop their creativity, innovation, and readiness to face rapid technological developments. This emphasizes the position of *pesantrens* not only as centers of religious learning but also as platforms that equip students with the skills to compete in an increasingly digital and modern world.<sup>17</sup>

The Industrial Era 4.0 has brought about major changes through digitalization, transforming various aspects of life, including shifting activities from offline to online and from hardcopy to softcopy. One example of this change is the digitization of the Quran, which is now available in various applications, both on mobile platforms and websites. One innovation that can be applied to Quran applications is AI. The application of AI in this Quran application is expected to provide greater convenience and benefits for its users,<sup>18</sup> while also supporting the development of creativity and digital skills.<sup>19</sup> In addition to the digitalization of the Quran, the application of AI in Quran studies offers numerous opportunities, from increasing access to information to in-depth text analysis. Quran learning can also be personalized by leveraging AI to provide a more interactive and enjoyable experience, and by preserving ancient Quran manuscripts through digitization and restoration.

While AI holds significant potential to enhance Quranic studies, several challenges remain in its implementation. One key challenge is ensuring the accuracy and objectivity of AI interpretations of Quranic verses. Therefore, it is crucial to develop AI algorithms capable of accurately understanding the context and meaning of the Quran, while also taking into account the various interpretations of scholars. To address these challenges, several solutions can be considered. First, AI algorithms must be developed to understand the context and meaning of the Quran. Second, AI development must involve close collaboration with Quranic experts. Third, AI interpretations need to be rigorously evaluated and validated by experts to avoid bias. While AI can assist in understanding and interpreting the Quran, the role of humans remains irreplaceable, as AI is a tool, not a substitute for humans.<sup>20</sup>

Another innovation is the use of AI to improve information systems within *pesantren*. The integration of technology in these schools aims not only to facilitate learning but also to teach students to use technology productively and responsibly. This is a crucial step in preparing

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<sup>16</sup> Abdul Ghaffar Rozin, "Preserving Values, Embracing Changes: Facing the Technological Transformation of Pesantren," paper presented at The 1st International Conference on Pesantren and Islamic Studies (ICoPIS), IAI An-Nawawi Purworejo, May 7, 2024.

<sup>17</sup> Siti Mutmainah, Khurin'In Ratnasari, and Dukan Jauhari F Ratnasari, "Building Digital Skills and Introducing AI for Santri Through a Training Program at the As-Sunniah Islamic Boarding School in Kencong Jember," *International Journal of Community Service Learning* 8, no. 1 (May 2024): 115–21, <https://doi.org/10.23887/ijcsl.v8i1.76313>.

<sup>18</sup> Mohammad Andryan and Aji Wibawa, "Inovasi Aplikasi Al-Qur'an dengan Menerapkan Artificial Intelligence di Era Society 5.0," *Jurnal Inovasi Teknologi dan Edukasi Teknik* 2, no. 3 (March 2022): 101–2, <https://doi.org/10.17977/um068v2i32022p101-107>.

<sup>19</sup> Budi Al Amin and Candra Agustina, "Pengenalan Artificial Intelligence Pada Pondok Pesantren Yatim Al Ikhsan Surakarta," *Kesejahteraan Bersama: Jurnal Pengabdian dan Keberlanjutan Masyarakat* 1, no. 2 (2024): 92, <https://doi.org/10.62383/bersama.v1i2.158>.

<sup>20</sup> Moh. Mauluddin, "Kontribusi Artificial Intelligence (AI) pada Studi Al Quran di Era Digital; Peluang dan Tantangan," *Madinah: Jurnal Studi Islam* 11, no. 1 (June 2024): 101, <https://doi.org/10.58518/madinah.v11i1.2518>.

students to compete in the increasingly advanced digital era.<sup>21</sup> At Pesantren Al-Mubarak, innovation is achieved by combining AI-based edtech entrepreneurship with a neuro-coaching approach. By integrating AI into the curriculum, students can better understand this technology and develop innovative solutions that can increase their competitiveness. Through AI-based edu-technopreneurship mentoring with a neuro-coaching approach, students can be trained to develop technical skills and the ability to innovate, adapt, and make sound decisions to navigate the ever-changing dynamics of the job market.<sup>22</sup>

Thus, it can be concluded that *pesantren* are beginning to adopt AI technology to improve the effectiveness of education and management. Its utilization encompasses various aspects, such as online learning platforms that enable students to study flexibly, Quranic teaching applications, and more efficient administrative systems for managing student data. AI also supports *pesantren* da'wah (Islamic outreach) through digital media such as websites, social media, and interactive content, expanding the reach of *pesantren* in sharing knowledge and da'wah to a broader audience. This AI integration offers a significant opportunity for *pesantren* to enrich their students' digital skills to meet the needs and challenges of the current era.

### Integration of AI Technology in Salaf, Modern, and Combined *Pesantren*

*Pesantren* in Indonesia, with their unique characteristics, are now beginning to integrate technology to improve the quality of education and their relevance in the digital age. In the traditional *pesantren* model, known for its yellow-book approach, technology is being implemented, albeit with caution. Salaf *pesantren* tend to worry that the use of gadgets could disrupt learning, concentration, and traditional values. However, some Salafi *pesantren*, such as Pondok Pesantren Lirboyo in Kediri, are beginning to use digital applications such as *Maktabah Syamilah* to facilitate access to *Kitab Kuning*.<sup>23</sup> Furthermore, the Pondok Darussalam Blokagung in Banyuwangi has also adopted similar technology to enrich teaching materials.<sup>24</sup>

On the other hand, modern *pesantren* have been early adopters of technology in various aspects of education and management. Pondok Pesantren Darussalam Gontor in Ponorogo, East Java, is a modern *pesantren* that leverages technology to its full potential to support students' education and skills development. Founded in 1926 by KH. Ahmad Sahal, KH. Zainuddin Fananie, and KH. Imam Zarkasyi, the school has pioneered the integration of technology into the Islamic education system in Indonesia. Pondok Pesantren Darussalam Gontor has over

<sup>21</sup> Suparmadi Suparmadi, Zulkarnain Zulkarnain, and Akmal Akmal, "Pemanfaatan Teknologi Artificial Intelligence (AI) Mesin Pencari Informasi Pada Pesantren Bahrul Uluum Al-Kamal Asahan," *Jurdimas (Jurnal Pengabdian Kepada Masyarakat) Royal* 7, no. 1 (January 2024): 140, <https://doi.org/10.33330/jurdimas.v7i1.2942>.

<sup>22</sup> Basrowi et al., "Pendampingan Edu-Technopreneurship Berbasis AI Pada Santri PP. Al-Mubarak dengan Pendekatan Neuro Coaching Menuju Daya Saing dan Readiness Career Option," *Jurnal Abdimas Ilmiah Citra Bakti* 5, no. 3 (August 2024): 757–59, <https://doi.org/10.38048/jailcb.v5i3.3815>.

<sup>23</sup> Mohammad Waqiyulloh and Sri Susanti Tjahja Dini, "Literasi Digital Pesantren: Studi Praktik Literasi Digital Santri di Bahtsul Masail Al-Hikmah Kediri," *Mabad Aly Journal of Islamic Studies* 2, no. 2 (2023), <https://doi.org/10.63398/g6d9t132>; Ibnu Ato'ilah, Ahmad Munjin Nasih, and Dzulfikar Rodafi, "Pengajaran Fikih Lintas Mazhab Di Pondok Pesantren Lirboyo," *Intizar* 28, no. 2 (December 2022): 111–23, <https://doi.org/10.19109/intizar.v28i2.13870>.

<sup>24</sup> Siti Aimah, "Ngaji Literacy Values In Forming Education Moderation Digital Era At The Pesantren," *Proceedings of Annual Conference for Muslim Scholars* 7, no. 1 (December 2023): 516–25, <https://doi.org/10.36835/ancoms.v7i1.522>.

20,000 students and provides both religious-based education and general studies. Furthermore, the school has adopted digital technology to support learning and operational management.<sup>25</sup>

One of the latest innovations implemented at Gontor is the use of AI to support entrepreneurship training.<sup>26</sup> Research conducted at this *pesantren* shows a positive and significant influence between the use of AI and students' entrepreneurial interest. A total of 150 students who participated in AI-based entrepreneurship training showed an increased interest in starting independent businesses. This indicates that the greater students' understanding of AI and the more frequently they use it in entrepreneurial simulations, the greater their interest in entrepreneurship. These findings have a significant impact on the development of the *pesantren's* educational curriculum, particularly in preparing students with digital skills relevant to future needs. Thus, *Pesantren* Gontor produces graduates not only competent in religious matters but also prepared to face the challenges of the digital world and entrepreneurship.

Meanwhile, the *pesantren* combines traditional Salafi traditions with modern technology. *Pesantren* Tebuireng in Jombang, founded by KH. Hasyim Asy'ari in 1899 is an example of a *pesantren* that combines the teaching of *Kitab Kuning* with formal education from elementary school to university. With over 7,000 students, Tebuireng has begun integrating technology across various aspects, including e-learning platforms for supplementary materials and a digital administration system.<sup>27</sup> They also utilize social media and digital platforms to expand the reach of their da'wah and teachings.

Overall, traditional, modern, and combination *pesantren* have different approaches to adopting technology. Traditional *pesantrens* are more cautious and less inclined to use technology, while modern *pesantrens* integrate technology more aggressively. Combined *pesantrens* strive to maintain a balance between conventional methods and modern technology to prepare students for the challenges of the digital world, while adhering to long-standing Islamic values. This demonstrates a commitment to implementing a quality assurance system for all types of *pesantren*, as stipulated in Law No. 18 of 2019 on *Pesantren*. This system encompasses various aspects, including teaching standards, management, and curriculum, enabling *pesantren* to improve their quality. This way, *pesantren* graduates can compete with graduates from other formal educational institutions in the workforce.<sup>28</sup>

### The Role of *Kyai* as a Transformational Leader

Various models of *kyai* leadership in *pesantren* have been identified in research studies, including the religio-paternalistic, paternalistic-authoritarian, legal-formal, natural-style, and charismatic-traditional-rational models.<sup>29</sup> Religio-paternalistic leadership describes the

<sup>25</sup> Marsum Marsum and Abd. Wahab Syahroni, "Efektifitas Penggunaan Teknologi pada Pesantren Modern dalam Menghadapi Revolusi Industri 4.0," *Jurnal Kariman* 8, no. 02 (December 2020): 233–42, <https://doi.org/10.52185/kariman.v8i02.155>.

<sup>26</sup> Reza Fahmi, "Pengaruh Penggunaan AI Terhadap Minat Berwirausaha Santri di Pondok Pesantren Gontor Darussalam Ponorogo Jawa Timur," *Prosiding AnSoPS (Annual Symposium on Pesantren Studies)* 3 (December 2024): 246–50.

<sup>27</sup> Ayu Amalia, "Mengintegrasikan Teknologi dan Tradisi di Pesantren," *Tebuireng Online*, January 28, 2025, <https://tebuireng.online/mengintegrasikan-teknologi-dan-tradisi-di-pesantren/>.

<sup>28</sup> Abdul Halim dan Firdaus Jeka, "Meneropong Eksistensi Pendidikan Pesantren melalui Undang-Undang No.18 Tahun 2019," *INNOVATIVE: Journal of Social Science Research* 4, no. 4 (2024), <https://doi.org/10.31004/innovative.v4i4.14307>.

<sup>29</sup> Anasro Anasro and Muhammad Yusron Maulana El-Yunusi, "Leadership Style at the Contemporary Pesantren Al-Hilmi Prigen Pasuruan," *Journal of Pesantren and Diniyah Studies* 1, no. 1 (June 2024): 15–24, <https://doi.org/10.63245/jpds.v1i1.7>; Isa Anshory et al., "Kepemimpinan Kyai dalam Pondok Pesantren

relationship between *kyai* and students based on religious values, referring to the leadership style of the Prophet Muhammad SAW, in which the *kyai* serve as a figure who guides and educates with a religious approach. The paternalistic-authoritarian model of leadership features a leader who tends to be passive, giving students the freedom to be creative, yet retaining the authority to decide whether their work will continue or be stopped.

Legal-formal leadership emphasizes institutional mechanisms, in which each organizational element has a clear role and works together to support the institution's goals. On the other hand, natural-style leadership demonstrates a *kyai* who does not allow development proposals from outside the *pesantren's* policies, as all decisions rest entirely on the *kyai's* authority. Finally, charismatic-traditional-rational leadership refers to a central figure who is considered to possess supernatural powers and superiority in various scientific fields, with more collective leadership, prioritizing community participation, and utilizing a more complex organizational structure. Leadership is the ability to influence a group to change their views, attitudes, and beliefs willingly.<sup>30</sup> Leadership in an organization greatly influences members' involvement in planned activities, which ultimately determines the effectiveness and efficiency of these activities in achieving organizational goals.

In some circles, there are nuances in the *pesantren* world that raise questions about the role of religious leaders, particularly *kyai*, in facing the increasingly rapid development of AI technology. *Kyai* is used here as a representation, although important roles in *pesantren* are also held by other figures such as *bu nyai*, *gus*, *ning*, *ustaz*, *ustazah*, and so on. These religious leaders are also relevant in contexts beyond *pesantren*, since not all *kyai* are *pesantren* caretakers. In relation to AI, this technology is closely linked to intelligence, which, in a religious context, is highly relevant to important figures in Islam. In the study of prophecy, intelligence is one of the mandatory qualities of a prophet. In Hadith Science, a superior hadith narrator must possess the quality of *dhabit*, namely a strong memory and intelligence. In Usul Fiqh, a *mufti* or *mujtahid* must have intelligence and meet specific criteria to be a learned person.<sup>31</sup>

For a *kyai*, becoming an '*alim*' is an important achievement, although the level varies according to the context of the community.<sup>32</sup> A *santri* (Islamic student) who is studying can also be called an '*alim*' (student), as can a *gus* (son of a *kyai*) who is studying to succeed his father, the *kyai*. A *kyai* who has achieved the level of *tababbur* (profound understanding) is considered a highly skilled figure in his field. This '*alim*' label is achieved through a long process and mastery of various branches of knowledge, such as the Quran, Hadith, *aqidah* (belief), *fiqh* (jurisprudence), morals, linguistics, and others, some of which must be memorized. Within the world of *pesantrens*, there are specialized programs, such as Quranic boarding schools or book boarding schools, that excel in specific fields of knowledge. In the face of the development of AI technology, questions arise about whether the intelligence of Islamic scholars (*kyai*) in

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Modern," *Intelletika: Jurnal Ilmiah Mahasiswa* 2, no. 5 (2024): 229, <https://doi.org/10.59841/intellektika.v2i5.1578>; Suhermanto Suhermanto and Moh Jasri, "Kiai Kampung and Transformational Leadership: A Model for Non-Formal Education to Improve Community Quality of Life," *Journal of Pesantren and Diniyah Studies* 1, no. 2 (December 2024): 165–74, <https://doi.org/10.63245/jpds.v1i2.25>.

<sup>30</sup> Jenal Aripin, "Gaya Kepemimpinan kharismatik *kyai* dalam pengembangan Pondok Pesantren Nurul Huda Cisompet Kabupaten Garut" (masters, UIN Sunan Gunung Djati Bandung, 2024), <https://digilib.uinsgd.ac.id/96939/>.

<sup>31</sup> Muhyidin Basroni, "Menjadi *Kyai* di Zaman 'Artificial Intelligence,'" 6 Juli 2023, (Dikutip dari laman: <https://pesantren.id/menjadi-kyai-di-zaman-artificial-intelligence-13590/>. Rabu, 11 Desember 2024, 13.15 WIB).

<sup>32</sup> Machfudz Machfudz, *Model Kepemimpinan Kiai Pesantren: Dari Tradisi hingga Membangun Budaya Religius*, Cetakan I (Kasihani, Bantul, Yogyakarta: Pustaka Ilmu, 2020).

religious knowledge can be replaced by the intelligence of AI robots. As happened in 1997, when Garry Kasparov lost to Deep Blue in a chess game, AI intelligence is now starting to compete with human intelligence.<sup>33</sup>

If an AI robot can memorize and master Islamic religious knowledge, such as the Quran with its various qira'at, tajwid, Arabic grammar, fiqh, tauhid, and related subjects, then it will be able to answer questions about fiqh law, give sermons, and even recite prayers. Although this condition still sounds strange, technological advances make it possible for this to become a reality in the future. Thus, if AI displaces religious intelligence, the role of religious leaders, particularly kyai, should not be viewed as competitors, but rather as partners. Throughout history, humanity has often resisted new technologies related to religion, yet these technologies have ultimately been accepted and utilized. When used appropriately and with positive goals, AI technology can enrich the role of religious leaders in guiding the community.

### Optimism of Pesantren in the AI Era

As Islamic educational institutions, *pesantren* have great potential to adapt and thrive in the era of AI. By utilizing modern technology, they can improve the quality of education, expand access to information, and prepare students to face the challenges of the times. One step that can be taken is the integration of technology into learning, such as the development of AI-based applications that support the learning process, such as applications to help memorize the Quran or chatbots that can answer questions about Islamic jurisprudence (fiqh). Some *pesantrens*, such as Pondok Pesantren Modern Al-Ittihad di Cepu, have even opened special classes to teach students about AI, aiming to ensure they not only understand religion but also master relevant technology. Furthermore, AI can improve the quality of education by creating a reading recommendation system that is tailored to students' interests and learning progress. Teachers can also utilize this technology to monitor student progress and provide more targeted, effective feedback. *Pesantrens* can also offer digital skills training, such as programming and data analysis, to equip students with the competencies they need in the digital world.<sup>34</sup>

Several responses to technology in *pesantren* demonstrate the ongoing debate, particularly regarding its use in religious education. One such viewpoint is the conflicting opinions, as seen in the *fatwa* on the use of social media like Facebook.<sup>35</sup> *Pesantren* must be able to formulate a clear stance on the validity of technology amidst the significant changes occurring in this era of disruption.<sup>36</sup> Technology can be a tool (*wasilah*) that supports Islamic education (*tarbiyah*), provided it serves its objectives and benefits its users, particularly in the *pesantren* context. However, *pesantren* must also maintain their traditional values while adapting to technological advances.

<sup>33</sup> Soffya Ranti, "AI Cetak Sejarah Kemenangan Tak Terlupakan 28 Tahun Lalu," KOMPAS.com, December 27, 2025, <https://tekno.kompas.com/read/2025/12/27/10010097/ai-cetak-sejarah-kemenangan-tak-terlupakan-28-tahun-lalu>.

<sup>34</sup> Abdul Khalim Mahfur, "Pesantren Al-Ittihad Cepu Jadi Pelopor Perkenalkan AI pada Santri," 23 Oktober 2024, (Dikutip dari laman: <https://jateng.nu.or.id/pesantren/ponpes-al-ittihad-cepu-jadi-pelopor-perkenalkan-ai-pada-santri-Awoi5>, pada 11 Desember 2024, 13.20 WIB).

<sup>35</sup> Muhammad Abror Rosyidin, "Pentingkah Bahtsul Masail?," *Tebuireng Online*, August 29, 2016, <https://tebuireng.online/pentingkah-bahtsul-masail/>; Syamsuddin Sakka and Muhammad Syakir Al-Kautsar, "Penerapan Kaidah Fiqh Dalam Hukum Media Sosial Di Era Globalisasi Ilmu Pengetahuan Dan Teknologi," *Palita: Journal of Social Religion Research* 9, no. 2 (October 2024): 117–28, <https://doi.org/10.24256/pal.v9i2.5177>.

<sup>36</sup> Ahmad Khuza'i Faruq, Hepni Hepni, and Sujiwo Sujiwo, "Technology and Noble Traditions in Pesantren," *Edukasi Islami: Jurnal Pendidikan Islam* 11, no. 02 (October 2022), <https://doi.org/10.30868/ei.v11i02.2385>.

In the view of *Kyai* Rozin, Chairman of the Tanfidziyah PWNU Central Java, *pesantren* need to acknowledge that major technological changes must be balanced with a proper understanding of their use in the world of education.<sup>37</sup> Although the technology is highly advanced, what is more important is the ability of its users to use it wisely and to continue practicing reference searches through classical texts, rather than relying solely on more practical techniques such as "*fikih prasamanan*".<sup>38</sup> Although *pesantren* are beginning to adopt technology, it is crucial to maintain religious values in its use. Technology must be used wisely to uphold Islamic principles. In this context, AI can also be used as a tool for digital da'wah (Islamic outreach), where students are taught to spread Islamic messages through digital platforms that can reach a wider audience. Furthermore, *pesantrens* have the potential to become research centers for developing AI technology grounded in Islamic values, opening up opportunities for collaboration with educational institutions and industry, both nationally and internationally.

However, amid optimism about the development of AI technology, it is important to emphasize that this technology cannot replace the role of religious scholars. As reported by Umsida.ac.id, Mr. Irwan, a lecturer in Informatics at Umsida, emphasized that as Muslims, we must believe that worldly knowledge, including AI, can only develop with the permission of Allah Almighty.<sup>39</sup> According to him, the development of AI is a test from Allah to measure the extent to which humans can improve the quality of their worship. AI allows machines to learn from experience and perform tasks like humans, but AI cannot replace the role of religious scholars. AI is not designed to solve problems in depth and does not possess the kind of accurate intelligence humans do. Therefore, although AI can make things easier, the role of religious scholars in guiding Muslims in religious aspects remains irreplaceable.

## CONCLUSION

*Pesantren* education faces significant challenges in integrating technology, particularly in the context of AI and social media. While technology can be an effective tool for supporting the tarbiyah (Islamic education) process, debate and concern persist about its impact on traditional *pesantren* values. Some argue that *pesantrens* must respond to this era of disruption with a wise approach, maintaining religious values while adapting to technological developments. Technology should be positioned as a supportive tool (*wasilah*), not an end in itself, in education. Therefore, the development of a robust digital infrastructure and a thorough understanding of technology appropriate to the *pesantren* context are essential.

This research suggests that *pesantrens* should adopt a cautious approach to integrating technology, including AI, while involving scholars and administrators at every stage of development and implementation. They should create in-depth digital databases to support the learning process and use technology to increase access to knowledge, rather than replacing proven traditional methodologies. Furthermore, it is crucial to continue training the younger generation to seek guidance from classical texts, ensuring they remain connected to the roots of Islamic scholarship. In this regard, the collaboration between technology and a deep understanding of religion will be key to ensuring that *pesantren* remain relevant and effective in

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<sup>37</sup> Syarif Abdurrahman, "Empat Fokus Transformasi Digital di Pesantren menurut Gus Rozin," NU Online, Desember 2021, <https://www.nu.or.id/nasional/empat-fokus-transformasi-digital-di-pesantren-menurut-gus-rozin-rv6Hc>.

<sup>38</sup> Tim Humas, "Usung 'Fikih Prasmanan' Musahadi Dikukuhkan Menjadi Guru Besar," Berita, UIN Walisongo, January 8, 2020, <https://walisongo.ac.id/indonesia-usung-fikih-prasmanan-musahadi-dikukuhkan-menjadi-guru-besar/>.

<sup>39</sup> Kumara Adji, *AI Tak Bisa Gantikan Peran Ulama Ini Penjelasan Dosen Umsida*, Opini, February 23, 2023, <https://umsida.ac.id/ai-tak-bisa-gantikan-peran-ulama-kata-dosen-umsida/>.

providing an education aligned with current developments without sacrificing fundamental religious values.

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