Ál-fâhim: Jurnal Manajemen Pendidikan Islam
Volume 8 No. 2. March-September 2026
ISSN: 2656-226X; E-ISSN: 2656-6036
DOI: 10.54396/alfahim.v8i2.2741

Technology-Based Management Innovation and Cross-Stakeholder Collaboration In Realizing Sustainable Digital Governance at Sunan Drajat Lamongan Islamic Boarding School

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Abstract: *This study aims to analyze technology-based management innovations and cross-stakeholder collaboration in realizing sustainable digital governance at Sunan Drajat Islamic Boarding School in Lamongan. The study employed a qualitative approach with a case study design. Data were collected through semi-structured interviews with six informants, non-participant observations, and documentation of institutional documents, application implementation, official publications, and relevant scientific literature. Data were analyzed using the interactive model of Miles, Huberman, and Saldaña, through data condensation, data display, and conclusion drawing and verification. The findings show that digital transformation at Sunan Drajat Islamic Boarding School is supported by collaboration among the pesantren, government institutions, financial institutions, business actors, and inter-pesantren networks, forming a sustainable innovation ecosystem. The implementation of Santri Link and Sundra SuperApp integrates administrative management, educational services, financial transactions, and business unit management, thereby strengthening the effectiveness, transparency, and accountability of pesantren governance. Digital transformation also contributes to strengthening economic independence, improving services for students and parents or guardians, and supporting community empowerment. The study concludes that the integration of Triple Helix Innovation, Transformational Leadership, and Digital Governance contributes to the development of an adaptive, collaborative, and sustainable digital governance model for Islamic Education Management.*
Keywords: *Digital Governance, Digital Transformation, Management Innovation, Triple Helix Innovation, Islamic Education Management.*

Introduction

Digital transformation has become one of the strategic agendas in the development of educational organizations in the era of the Industrial Revolution 4.0 and Society 5.0.[1] Digital transformation is no longer understood only as a process of information technology adoption, but as a systemic change that includes organizational governance, work culture,

[1] Huma Akram, Abbas Hussein Abdelrady, Ahmad Samed Al-Adwan, and Muhammad Ramzan, "Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review," *Frontiers in Psychology* 13 (2022), https://doi.org/10.3389/fpsyg.2022.920317

|Submitted: July 17, 2026 | Accepted: Oct 08, 2026 | Published: Nov 02, 2026

decision-making processes, service innovation, and sustainable human resource capacity development.[2] In the education sector, digital transformation allows institutions to improve administrative effectiveness, resource management efficiency, organizational transparency, and data-driven decision-making which ultimately has an impact on improving the quality of educational services.[3] These developments show that digitalization has become a strategic need for educational institutions in the face of increasingly dynamic and competitive environmental changes.[4]

In the context of Islamic education, digital transformation has different characteristics compared to educational institutions in general.[5] Digitalization is not only directed to improve administrative efficiency, but must also be able to maintain Islamic values, pesantren culture, and educational character which are the main identity of pesantren.[6] Therefore, digital transformation in the pesantren environment needs to be seen as a process of organizational change that integrates technology with religious values so that it is able to create modern governance without eliminating the tradition of Islamic education. Baihaqi (2026) emphasized that the success of digital transformation in Islamic educational institutions is highly determined by the ability to integrate technology, human resource competency development, and learning innovations into the institutional system as a whole.[7]

As the oldest Islamic educational institution in Indonesia, Islamic boarding schools face increasingly complex challenges in responding to the

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[2] Eric Allouche, *Digital Transformation of Education, Systems Approach and Applied Research* (arXiv, 2024), https://doi.org/10.48550/arXiv.2406.11861

[3] Zuraida Zuraida and Mahbub Setiawan, "Digital Transformation in Pesantren: Strengthening Educational Management, Science Learning Innovation, and Sustainable Islamic Education," *PEMA: Jurnal Pendidikan dan Pengabdian Kepada Masyarakat* 5, no. 3 (2025): 583–592, https://doi.org/10.56832/pema.v5i3.2172

[4] Mohamad Anas, Millatuz Zakiyah, Prima Zulvarina, and M. Lukman Hakim, "Transformasi Digital Manajemen Pendidikan Islam: Program Pembinaan Berbasis Komunitas untuk Pesantren dan Sekolah Islam di Malang Raya," *JMM (Jurnal Masyarakat Mandiri)* 10, no. 3 (2026), https://doi.org/10.31764/jmm.v10i3.38995

[5] Nofa Tria Rohana, Tri Wahyudi Ramdhan, and Musohihul Hasan, "Digital Pesantren Transformation Strategies Within The Modern Islamic Education Landscape: A Systematic Literature Review (SLR) 2021–2026," *AR-RASYID: Jurnal Pendidikan Agama Islam* 6, no. 1 (2026): 49–62, https://doi.org/10.30596/arrasyid.v6i1.29917

[6] Mohammad Hosnan, Ahmad Barizi, and Abdul Halim, "Strategic Digital Transformation of Pesantren: Disseminating Islamic Wasathiyah Values Through Online Media," *Nidhomul Haq: Jurnal Manajemen Pendidikan Islam* 11, no. 1 (2026): 269–282, https://doi.org/10.31538/ndhq.v11i1.346

[7] Achmad Baihaqi, Afdillah Nur Rahman, Nurhasanah, Fariza Rahma Jenery, and Sali Husnaini Fitri, "Digital Transformation in Madrasah Education: A Conceptual Framework for Integrating Higher-Order Thinking Skills and Internet of Things in Teaching," *Journal of Instruction and Islamic Religious Education* 2, no. 1 (2026): 68–83, https://doi.org/10.63826/jiire.v2i1.198

development of digital technology. On the one hand, Islamic boarding schools are required to adopt various technological innovations to improve the effectiveness of governance, the quality of educational services, and institutional competitiveness.[8] On the other hand, pesantren must still maintain their characteristics as educational institutions based on Islamic values that place kiai, pesantren culture, and character development as the main foundation for the implementation of education.[9] Thus, digital transformation in Islamic boarding schools is not just a technological change, but an institutional adaptation process that must remain oriented to religious values, organizational sustainability, and the benefit of the community.[10]

Various studies show that the digitalization of Islamic boarding schools has developed through the implementation of management information systems, digitization of administrative services, technology-based learning, and the development of integrated digital governance. Tantowi et al. (2025) show that the use of information technology in pesantren management is able to increase administrative effectiveness, speed up services, improve data accuracy, and strengthen communication between managers, teachers, students, and guardians of students.[11] Sunaji (2025) explained that the digital transformation of pesantren not only changes the administrative system through applications and information systems, but also encourages changes in organizational culture, increased digital literacy, and strengthens institutional accountability.[12] Meanwhile, Zuraida and Setiawan (2025) emphasized that digitalization is able to strengthen education management, learning innovation, and the sustainability of Islamic education through the integration of information technology.[13]

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[8] Langgeng Sutopo, "Digital Good Governance in Pesantren-Based Madrasas: A Conceptual Model," *Mudir: Jurnal Manajemen Pendidikan* 8, no. 2 (2026): 637–649, Retrieved from https://ejournal.unsuda.ac.id/index.php/MPI/article/view/2848/1542

[9] Karman, Rosihon Anwar, and Lukman Hakim, "The Qur'anic Learning Based on Islamic Eco-Theology at Pesantren," *Jurnal Pendidikan Islam* 9, no. 2 (2023): 169–186, https://doi.org/10.15575/jpi.v9i2.24933

[10] Namiyah Fitriani, Rima Ayu Handayani, Putri Fatimah Azzahrah, and Dian Afrilianti, "Peran Lingkungan Pesantren Terhadap Pertumbuhan UMKM Lokal," *BERBAKTI: Jurnal Pengabdian Kepada Masyarakat* 3, no. 2 (2025): 154–160, https://doi.org/10.30822/gxcf3e82

[11] Ahmad Tantowi, Muhammad Ali Gunawan, and Abdullah Ibrahim, "Optimizing Islamic Boarding School Management in the Digital Era: Analysis of Technology Effectiveness in Administration and Operations," *Munaddhomah: Jurnal Manajemen Pendidikan Islam* 6, no. 2 (2025): 295–309, https://doi.org/10.31538/munaddhomah.v6i2.1738

[12] Sunaji, "Pengembangan Pesantren Modern Melalui Digitalisasi Sistem Pendidikan Islam Berbasis Santrilink," *Kamil: Journal of Education* 1, no. 1 (2025): 1–9, https://doi.org/10.65065/w1dqrc25

[13] Zuraida and Setiawan, "Digital Transformation in Pesantren,"

The development of digital innovation in the pesantren environment is also marked by the presence of various technology-based platforms, such as Santri Link, UQI Smart System,[14] and various digital service applications that support integrated administration, communication, and educational services.[15] In addition to increasing the effectiveness of governance, digitalization also encourages the development of pesantren economic innovation through the use of financial technology, digitization of cooperatives, and strengthening entrepreneurship based on Islamic values.[16] This condition shows that digital transformation in the pesantren environment has developed into an institutional strengthening strategy that includes aspects of education, economy, and community empowerment.[17]

However, most previous research has focused on the implementation of information technology as an instrument to improve administrative efficiency or digitize educational services. The research of Tantowi et al. (2025) focuses more on the effectiveness of pesantren administration, while Sunaji (2025) emphasizes historical and organizational cultural changes in the digitalization process. Rohana's research (2026) through systematic literature review also shows that studies on the digital transformation of Islamic boarding schools are still dominated by discussions about the adoption of technology and information systems. Thus, studies that integrate technological innovation, transformational leadership, digital governance, and cross-stakeholder collaboration as a model for sustainable pesantren development are still relatively limited. In addition, the concept of digital governance in Islamic educational institutions is also still widely discussed conceptually, so it requires empirical proof of its implementation in the context of modern Islamic boarding schools.[18]

Based on these conditions, this study uses the Triple Helix Innovation developed by Etzkowitz and Leydesdorff as a framework to explain that innovation is born through synergy between the government, the business

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[14] Dewi Septiani Dewi, "Transformasi Digital Manajemen Pesantren: Implementasi UQI Smart System di Pondok Pesantren Modern Ummul Quro Al-Islami Bogor," *As-Sulthan Journal of Education* 3, no. 2 (2026), https://ojssulthan.com/asje/article/view/936

[15] Sunaji, "Pengembangan Pesantren Modern Melalui Digitalisasi Sistem Pendidikan Islam Berbasis Santrilink."

[16] Anas Alhifni, Biyati Ahwarumi, Martin Roestamy, Radif Khotamir Rusli, and Warizal, "The Cultural Embeddedness of Economic Action: Islamic Values, Entrepreneurship, and FinTech Innovation," *Journal of Cultural Analysis and Social Change* 10, no. 4 (2025): 95–104, https://doi.org/10.64753/jcasc.v10i4.2782

[17] Fauzan Fadhil Ma'ruf and Anas Alhifni, "Sosialisasi Peningkatan Pengetahuan Masyarakat Mengenai Perbedaan Ekonomi Syariah dan Ekonomi Konvensional Di Desa Padamulya," *ALMUJTAMAE: Jurnal Pengabdian Masyarakat* 2, no. 1 (2022): 23–28, https://doi.org/10.30997/almujtamae.v2i1.2951

[18] Sutopo, "Digital Good Governance in Pesantren-Based Madrasas: A Conceptual Model,"

world, and educational institutions.[19] The framework is combined with the theory of Transformational Leadership which emphasizes the importance of visionary leadership in driving organizational change, building an innovative culture, and accelerating technology adoption.[20] In addition, the concept of Digital Governance is used to explain how the use of technology can increase transparency, accountability, effectiveness, and participation in the governance of educational institutions.[21] The integration of these three perspectives is expected to provide a more comprehensive understanding of digital transformation in Islamic educational institutions.

Sunan Drajat Lamongan Islamic Boarding School is one of the Islamic boarding schools that has succeeded in developing a comprehensive digital transformation through the implementation of the Santri Link application, the development of Sundra SuperApp, the digitization of administration, a cashless transaction system, and the integration of educational services and the economy of the Islamic boarding school. This success is supported by strategic collaboration with various stakeholders, including the Ministry of MSMEs, the Ministry of Industry, Bank Indonesia, LPDB-KUMKM, local governments, and the Islamic Boarding School Business Union (KSBP) Cooperative network. This synergy shows that the success of digital transformation is not only determined by technological readiness, but also by the ability to build a collaborative ecosystem that supports institutional innovation, economic empowerment, and organizational sustainability.

Based on this description, this study aims to analyze how technology-based management innovation and cross-stakeholder collaboration at Sunan Drajat Lamongan Islamic Boarding School form sustainability-oriented digital governance. The novelty of this research lies in the integration of the perspectives of Triple Helix Innovation, Transformational Leadership, and Digital Governance in explaining the digital transformation of Islamic boarding schools comprehensively. In contrast to previous research that tends to view digitalization as a partial implementation of technology or information systems, this study positions digital transformation as the result of interaction between visionary leadership, technological innovation, cross-stakeholder collaboration, and sustainable digital governance based on Islamic values. Therefore, this research is expected to make a theoretical contribution to the development of Islamic Education Management studies as well as become a practical model for other Islamic boarding schools in developing effective, adaptive, transparent, accountable, and sustainable digital governance.

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[19] Henry Etzkowitz, *The Triple Helix: University–Industry–Government Innovation in Action* (New York: Routledge, 2008), hlm. 9.

[20] Bernard M. Bass and Ronald E. Riggio, *Transformational Leadership*, 2nd ed. (Mahwah, NJ: Lawrence Erlbaum Associates, 2006), 6.

[21] Michael E. Milakovich, *Digital Governance: Applying Advanced Technologies to Improve Public Service*, 2nd ed. (New York: Routledge, 2022), 27.

Methods

This study employed a qualitative approach with a case study design. This design was selected to gain an in-depth understanding of digital transformation, technology-based management innovation, and cross-stakeholder collaboration in developing sustainable digital governance at Sunan Drajat Islamic Boarding School (PPSD) in Lamongan. The case study approach was employed because the research focuses on a contemporary phenomenon within its real-life context and enables the researcher to comprehensively examine the relationships among practices, actors, and institutional conditions.[22]

The research was conducted at Sunan Drajat Islamic Boarding School, Lamongan, East Java, from Mey to July 2026. The research site was purposively selected because PPSD Lamongan has developed the use of digital technology in educational management, student and parent or guardian services, financial transactions, and business unit management through the Santri Link and Sundra SuperApp applications. The research focused on the PPSD Economic Office, areas where Santri Link and Sundra SuperApp were utilized, Sunan Drajat Department Store (Toserba Sunan Drajat), Sunan Drajat Cooperative, and the PPSD Service Office.

The research data consisted of primary and secondary data. Primary data were obtained directly from informants through interviews and from observations of digital governance practices within the pesantren. Informants were selected purposively based on their involvement in and knowledge of the digital transformation process and institutional management. The study involved six informants, consisting of the head of Sunan Drajat Islamic Boarding School, the chief executive of the PPSD Economic Division, a member of the PPSD Information Technology (IT) team, a PPSD administrator, and parents or guardians and members of the surrounding community. Informants were selected based on their direct experience or relevant knowledge of the research focus.

The interviews were conducted using a semi-structured and in-depth approach based on an interview guide developed according to the research focus. The interviews explored the digital transformation process, the rationale for developing and implementing the applications, the role of leadership, forms of stakeholder collaboration, changes in organizational management mechanisms, the benefits and challenges of digitalization, and its contribution to institutional, economic, and social sustainability. Each interview was conducted in person and lasted approximately 10–15 minutes. The interview process was documented through field notes after obtaining the informants' consent.

Non-participant observations were conducted at the research site. The observations focused on the use of digital systems in administrative activities,

[22] R. K. Yin, *Case Study Research and Applications: Design and Methods*, 6th ed. (Sage Publications, 2018), 15.

services for students and parents or guardians, financial transactions, business unit management, and forms of coordination among units related to digital governance. The researcher recorded the use of technology, interactions among actors, service processes, and institutional conditions relevant to the research focus. The observations were conducted to obtain data on actual practices, which were subsequently compared with the interview and documentary data.

Secondary data were used to complement and corroborate the primary data. Secondary data included official documents of the Sunan Drajat Islamic Boarding School Foundation, institutional policy documents, activity reports, information and documentation concerning the implementation of Santri Link and Sundra SuperApp, national and international journal articles, scholarly books, ministry reports, government publications, and other relevant documents. Documents were selected based on their relevance to the research focus, source credibility, and recency. The scholarly literature primarily consisted of publications from the previous five years, while earlier literature was retained when it had theoretical relevance to the study.

Data were collected through in-depth interviews, observations, and documentation. These three techniques were used in an integrated manner to obtain information from multiple sources and compare information provided by informants, findings from field practices, and information recorded in documents. The use of multiple data collection techniques also enabled the researcher to conduct triangulation to enhance the credibility of the findings.

The unit of analysis in this study was digital governance practices at Sunan Drajat Islamic Boarding School, with particular attention to the processes and relationships among the elements that shape the pesantren's digital transformation. The unit of analysis encompassed technology-based management innovation, leadership in digital transformation, cross-stakeholder collaboration, service and information integration, and institutional, economic, and social sustainability. The analysis was conducted at the institutional level while taking into account the experiences and perspectives of the actors involved in the process.

Data analysis employed the interactive model of Miles, Huberman, and Saldaña (2014), consisting of data condensation, data display, and conclusion drawing and verification. The analysis began with transcribing the interview data and organizing observation notes and research documents. The researcher then conducted coding by assigning codes to information relevant to the research focus. Coding was performed progressively by grouping initial codes into broader categories and subsequently developing them into research themes.[23] These themes included technological innovation, transformational leadership, cross-stakeholder collaboration, digital governance, institutional sustainability, economic sustainability, and social

[23] M. B. Miles, A. M. Huberman, and J. Saldaña, *Qualitative Data Analysis: A Methods Sourcebook*, 3rd ed. (Sage Publications, 2014), 12.

sustainability. The categorized data were then presented in analytical narratives to identify patterns, relationships, and meanings within the phenomenon under investigation. The findings were subsequently interpreted in relation to the perspectives of Triple Helix Innovation, Transformational Leadership, and Digital Governance.

Data trustworthiness was ensured through source and technique triangulation. Source triangulation was conducted by comparing information from institutional leaders, managers, students, parents or guardians, and relevant stakeholders, according to the informants involved in the study. Technique triangulation was conducted by comparing interview, observation, and documentation data. The researcher also employed peer debriefing and an audit trail to enhance the credibility, dependability, and confirmability of the data. Transferability was supported by providing sufficient descriptions of the research context and characteristics of the research site, allowing readers to assess the relevance of the findings to other contexts.

Through this research design, the study not only describes the presence of digital technology at Sunan Drajat Islamic Boarding School but also analyzes how technology is utilized, how actors and stakeholders contribute to the transformation process, and how digitalization influences governance and the sustainability of the pesantren as an institution.

Result and Discussion

Results

Cross-Stakeholder Collaboration in Building Digital Governance of Islamic Boarding Schools

The findings indicate that digital transformation at Sunan Drajat Islamic Boarding School (PPSD) Lamongan does not occur as an internal process that relies solely on the institution's technological readiness. Rather, the transformation develops through interactions between the pesantren and various stakeholders with different resources, capacities, and roles. These stakeholders include the central government, local government, financial institutions, business actors, and inter-pesantren networks. This finding indicates that PPSD's digital governance is developed through an ecosystem approach, in which external resources are utilized to strengthen the pesantren's internal capacity to manage educational and economic activities.[24]

The government, through the Ministry of Micro, Small, and Medium Enterprises (MSMEs) and the Ministry of Industry, supports pesantren entrepreneurship development, cooperative digitalization, and institutional capacity building. At the local level, the Lamongan Regency Government provides support through community economic empowerment programs and the strengthening of pesantren-based education. Meanwhile, Bank

[24] Interview with the Director of Economic Affairs at the Pesantren Sunan Drajat, A.A, on May 29, 2026.

Indonesia and the Revolving Fund Management Institution for Cooperatives, Micro, Small, and Medium Enterprises (LPDB-KUMKM) contribute to strengthening financing systems, developing pesantren cooperatives, and expanding access to digital financial services.[25]

The pattern of stakeholder involvement indicates that each stakeholder does not perform the same function but addresses different needs within the digital transformation process. Government institutions provide policy support and capacity building, financial institutions contribute to financing and financial services, while inter-pesantren networks expand opportunities for knowledge and resource exchange. Therefore, cross-stakeholder collaboration at PPSD has a strategic function because it reduces the pesantren's dependence on internal resources while expanding its capacity to develop technology-based governance.

In addition to support from government and financial institutions, PPSD has established a collaborative network with 17 Islamic boarding schools that are members of the Koperasi Serikat Bisnis Pesantren (KSBP). This network serves not only as a platform for economic cooperation but also as a space for information exchange, innovation development, product distribution, human resource capacity building, and the strengthening of digital-based institutional governance. Through these relationships, pesantren are able to share resources, experiences, and innovations in responding to the demands of digital transformation. [26]

This finding demonstrates that inter-pesantren networking functions as an organizational learning mechanism. Pesantren do not need to develop all digital capacities independently, as experiences and innovations from other institutions can serve as sources of learning for improving internal systems. This pattern indicates that collaboration in digital transformation extends beyond administrative or economic cooperation and develops into a mechanism for knowledge transfer and institutional capacity strengthening.

Therefore, digital transformation at PPSD develops through a collaborative ecosystem that connects various actors within an integrated innovation process. The finding reinforces the argument that successful digitalization cannot be measured solely by the availability of technological infrastructure. It also depends on the institution's ability to connect technology with resources, knowledge, financing, and institutional support from various stakeholders. In this context, collaboration becomes a mechanism that enables digital innovation to be maintained and further developed in a sustainable manner.

Implementation of Technology-Based Management Innovation

[25] Interview with the Director of Economic Affairs at the Pesantren Sunan Drajat, A.A, on May 29, 2026.

[26] Interview with the Head of the Pesantren Sunan Drajat, N.R, on June 15, 2026.

The findings indicate that PPSD has developed various integrated digital innovations as part of its institutional governance modernization. One of the major innovations is the Santri Link application, an information system used to support student administration, digital attendance, cashless transactions, discipline monitoring, and real-time information delivery to students' guardians. The system transforms previously manual administrative processes into faster, more structured, and better-documented digital services.[27]

The finding indicates that Santri Link has a broader managerial function than merely digitalizing administrative procedures. The integration of administration, attendance, transactions, monitoring, and communication within a single system demonstrates the pesantren's effort to connect various student management processes through an integrated information flow. Data generated from students' daily activities can therefore become part of monitoring and decision-making processes. Technology consequently functions as an information infrastructure that supports management processes rather than merely serving as a tool for accelerating administrative work.

PPSD has also developed Sundra SuperApp as a digital platform that integrates various pesantren economic services into a single system. The platform provides services including educational fee payments, cooperative transactions, marketplace services, distribution of business-unit products, and other economic transactions. This integration enables pesantren economic activities to be digitally recorded, thereby facilitating monitoring, evaluation, and decision-making by pesantren managers.[28]

The development of Sundra SuperApp demonstrates the expansion of technology from an administrative function toward the management of the pesantren's broader economic ecosystem. Digitalization is not limited to recording transactions but also connects various economic units within an integrated system. This finding indicates that technology-based management innovation at PPSD has an integrative character. Technology is used to connect educational, administrative, financial, cooperative, and business functions, resulting in a more coordinated flow of organizational information.[29]

Digitalization is also applied to institutional administration, financial data management, coordination among work units, and electronic document storage. The use of these technologies has resulted in a more integrated information system that accelerates service processes, improves data

[27] Observation and Interviews with Administrators Pesantren Sunan Drajat, M, on May 20, 2026.

[28] Interview with the IT Team Pesantren Sunan Drajat, S, on July 6, 2026.

[29] Interview with the IT Team Pesantren Sunan Drajat, S, on July 6, 2026.

accuracy, minimizes information duplication, and strengthens coordination among work units.[30]

Viewed as a whole, the implementation of these systems demonstrates a change in the organizational management pattern. Prior to digitalization, information tended to be distributed across different processes and work units. Through digital integration, information can be consolidated and utilized across functions. This finding indicates that technological innovation at PPSD is associated with changes in management mechanisms, particularly in information management, coordination, monitoring, and decision-making.

The findings further demonstrate that information technology at PPSD is no longer positioned merely as an administrative support tool but has developed into a strategic instrument for organizational governance. The integration of various digital services indicates a shift from conventional administration toward a data-driven management system. This shift is significant because the ability of the pesantren to manage and utilize data determines the extent to which technology can transform governance rather than merely convert manual services into digital ones.

The Impact of Digital Governance Implementation on Islamic Boarding School Management

The implementation of technology-based management innovations affects various aspects of PPSD management, particularly administration, economic activities, and social relations. In the administrative domain, integrated information systems improve data management, accelerate service delivery, reduce recording errors, and enhance transparency in institutional information management. Digitalization also facilitates coordination among work units, enabling decision-making to be conducted more rapidly based on available information.[31]

This finding indicates that the primary impact of digitalization on administration lies not only in time efficiency but also in changes in the quality of information used in management processes. When administrative data are properly documented and integrated, managers have a more systematic information base for monitoring and decision-making. Digitalization therefore creates conditions that support a shift from procedure-based management toward a management approach that relies more strongly on organizational information.

In the economic domain, the development of Sundra SuperApp and the Koperasi Serikat Bisnis Pesantren contributes to the expansion of pesantren economic activities. Digital transactions make financial management more orderly, accountable, and systematically documented. Based on the analyzed documents, the growth of economic activities also strengthens the pesantren's

[30] Interview with the Administrators of the Sunan Drajat Islamic Boarding School, M, pada 20 Mei 2026.

[31] Interview with the Head Pesantren Sunan Drajat, N.R, on June 15, 2026.

financial independence, enabling it to support institutional operations, provide educational subsidies for approximately 16,000 students, and offer various scholarship programs for high-achieving students.[32]

This finding indicates a relationship between digital innovation and the strengthening of the pesantren's economic capacity. Technology contributes to improving the organization of transactions and the management of economic information, while expanded economic activities provide resources for sustaining educational operations. Thus, the economic benefits of digitalization extend beyond transaction efficiency and contribute to the pesantren's capacity to maintain its educational functions through more independent sources of financing.

In the social domain, digitalization strengthens communication between the pesantren and students' guardians through faster, more transparent, and more accessible information delivery. The development of a pesantren-based economic ecosystem also creates opportunities for community empowerment through participation in various productive business units managed by the pesantren.[33]

These findings demonstrate that digital governance generates effects that extend beyond the internal boundaries of the organization. Digital communication systems strengthen relationships between the pesantren and students' guardians, while the development of economic units expands community participation. Digitalization therefore functions as a connecting mechanism between the pesantren's internal processes and external stakeholders. This pattern indicates that the effectiveness of digital governance can also be assessed through its capacity to expand institutional relationships and support the pesantren's broader social functions.

Sustainable Digital Governance as a Model for Islamic Boarding School Development

The findings indicate that digital governance at PPSD develops through three interrelated dimensions: institutional sustainability, economic sustainability, and social sustainability. These dimensions demonstrate that sustainable digital governance is not merely concerned with the availability of technology but also with the institution's capacity to maintain the benefits generated by technology for the organization and its stakeholders over the long term.[34]

Institutional sustainability is manifested through the development of integrated information systems, human resource capacity building, the digitalization of administrative processes, and leadership regeneration that is responsive to technological developments. These efforts strengthen the

[32] Documentation and Interviews with Management Pesantren Sunan Drajat, M, on May 20, 2026.

[33] Interview with Parents of Students Pesantren Sunan Drajat, L, on July 15, 2026.

[34] Interview with the Chief Executive for Economic Affairs Pesantren Sunan Drajat, A.A, on May 29, 2026.

organization's capacity to respond to environmental changes while improving the effectiveness of institutional governance.[35]

This finding indicates that technological sustainability depends substantially on the organization's capacity to manage and develop technological systems. Digital systems can operate sustainably when the pesantren has human resources capable of utilizing and improving those systems, as well as leadership capable of maintaining the direction of innovation. Institutional sustainability therefore serves as a foundation for the sustainability of digital transformation. Technology does not operate independently but requires human capacity and supportive leadership.

Economic sustainability is reflected in the diversification of business units supported by digital technology. The development of cooperatives, digital financial services, marketplaces, and various pesantren-based business activities provides sources of funding that support the institution's operations independently. This finding indicates that digitalization has a strategic position in connecting technology-based governance with the economic independence of the pesantren. Technology supports the management of economic activities, while the resulting economic capacity provides resources that help sustain organizational operations and educational services.[36]

Social sustainability is realized through educational subsidies, scholarship programs, strengthened inter-pesantren networks, and community empowerment through pesantren-based entrepreneurship activities. The use of information technology expands access to communication, increases community participation, and strengthens relationships between the pesantren and its stakeholders.[37]

This finding indicates that social sustainability serves as a dimension that connects the internal benefits of digitalization with the pesantren's social functions. When administrative efficiency and economic strengthening can be translated into educational subsidies, scholarships, and community empowerment, technology generates broader institutional value. Therefore, sustainable digital governance at PPSD can be understood as the organization's capacity to transform technological innovation into continuing benefits that support its educational, economic, and social functions.

These three dimensions form a mutually reinforcing relationship. Institutional sustainability provides the organizational capacity required to manage technology. Technology then supports the strengthening of economic activities, while economic capacity helps sustain educational services and social programs. At the same time, stakeholder networks expand the

[35] Interview with the Head of Pesantren Sunan Drajat, N.R, on June 15, 2026.

[36] Interview with the Management/Board Members Pesantren Sunan Drajat, M, on May 20, 2026.

[37] Interview with the Chief Executive for Economic Affairs Pesantren Sunan Drajat, A.A, on May 29, 2026.

resources, knowledge, and support required by the pesantren to maintain and develop its innovations.

Based on this pattern, digital transformation at PPSD can be understood as a governance model that integrates technological innovation, cross-stakeholder collaboration, and organizational sustainability. The findings indicate that digitalization gains strategic value when technology is embedded within a governance system that connects people, organizational structures, economic resources, and stakeholders. Thus, digital governance at PPSD represents more than a transition from manual to digital systems. It reflects a transformation in how the pesantren organize resources and develop institutional capacity to sustain Islamic education, economic empowerment, and social services.

Discussion

Cross-Stakeholder Collaboration as the Foundation for Islamic Boarding School Digital Transformation

The findings indicate that the success of digital transformation at Sunan Drajat Islamic Boarding School (PPSD) Lamongan is not determined solely by technological readiness but also by the institution's capacity to access and integrate various resources from outside the organization. The involvement of the Ministry of Micro, Small, and Medium Enterprises (MSMEs), the Ministry of Industry, the Lamongan Regency Government, Bank Indonesia, LPDB-KUMKM, and the Koperasi Serikat Bisnis Pesantren (KSBP) network has formed a collaborative ecosystem that supports institutional innovation. This finding indicates that collaboration functions as a mechanism for addressing the pesantren's internal resource limitations, particularly in terms of policy support, financing, capacity building, and network development. Therefore, PPSD's digital transformation does not develop merely through technological adoption but through the institution's ability to connect technology with institutional support available in its external environment.

The pattern of stakeholder involvement also indicates a division of functions within the digital transformation process. Government institutions provide policy support and institutional development programs, financial institutions strengthen access to financing and financial services, while inter-pesantren networks provide opportunities for knowledge, experience, and innovation exchange. This division of functions demonstrates that cross-stakeholder collaboration at PPSD is complementary in nature. Each actor contributes different resources to address the needs of the pesantren's digital transformation. This pattern is significant because digital transformation requires a combination of technology, human resources, financing, knowledge, and institutional legitimacy that may be difficult for a single institution to provide independently.

From the perspective of Triple Helix Innovation, innovation emerges through dynamic interactions among government, educational institutions,

and industry.[38] The findings of this study demonstrate that this principle of cross-sector interaction can be extended to the context of Islamic educational institutions with complex institutional characteristics.[39] PPSD does not merely perform an educational function but also manages cooperatives, productive business units, and pesantren-based business networks. This position enables the pesantren to serve as a meeting point between educational, economic, and community empowerment interests. In other words, the pesantren in this study is not merely a recipient of innovation from external stakeholders but also acts as an actor that processes and integrates these resources into its own institutional system.

This finding provides a more specific understanding of the application of the Triple Helix framework in the context of Islamic Education Management. Interaction among stakeholders does not stop at a relationship in which the government provides support and the pesantren receive the program. PPSD utilizes these networks to develop internal capacity, expand economic activities, and establish technology-based governance systems. This demonstrates that the value of collaboration lies in the institution's ability to convert external support into organizational capacity. Collaboration therefore becomes part of the innovation mechanism rather than merely a supporting factor for digital transformation.

This finding is consistent with Sunaji (2025), who argue that digital transformation in pesantren requires changes in organizational culture and strengthened institutional capacity.[40] Tantowi et al. (2025) also demonstrate that the use of information technology can improve the effectiveness of pesantren administration when supported by sound organizational governance.[41] These studies emphasize the importance of internal readiness in implementing digital transformation. However, the present study extends this perspective by demonstrating that PPSD's internal readiness develops through collaborative relationships with external stakeholders. Institutional capacity for digitalization is therefore not entirely predetermined but can be developed through interaction, resource exchange, and collaborative learning.

The findings also reinforce the educational collaboration model proposed by Wulan Priyanggani et al. (2026), which emphasizes that synergy among government, educational institutions, business actors, and communities is an

[38] Etzkowitz, *The Triple Helix, 16.*,

[39] Rituparna Chatterjee and Ipsita Roy, "Revisiting the Triple Helix: A Meta-Analysis of University-Industry-Government Collaboration and Its Impact on Innovation," *Industry and Higher Education*, published online August 18, 2026, https://doi.org/10.1177/09504222261478665

[40] Sunaji, "Development of Modern Islamic Boarding Schools."

[41] Tantowi, Gunawan, and Ibrahim, "Optimizing Islamic Boarding School Management in the Digital Era,"

important factor in improving the effectiveness of educational management.[42] In the context of PPSD, this synergy has a broader function because it not only improves the effectiveness of educational management but also supports economic development and digital governance. This finding indicates that the boundaries between educational management, economic management, and institutional relationships become increasingly interconnected as the pesantren develops technology-based governance.

The KSBP network involving 17 Islamic boarding schools further demonstrates the role of collaboration as a mechanism for sustaining innovation. Relationships among pesantren facilitate information exchange, product distribution, innovation development, and human resource capacity building. This finding demonstrates that the network does not merely expand market access and economic cooperation but also provides a space for inter-organizational learning. Through this process, knowledge and experience concerning business management and technology utilization can be shared among network members. Therefore, the sustainability of digital innovation is not determined solely by PPSD's ability to maintain its internal systems but also by its ability to sustain relationships that generate new knowledge and resources.

Based on these findings, cross-stakeholder collaboration can be understood as the foundation of PPSD's digital transformation through three primary mechanisms: resource provision, institutional capacity building, and inter-organizational learning. These mechanisms are interconnected. Stakeholder support provides the resources required for transformation, interaction among actors strengthens organizational capacity, and networks enable knowledge and innovation to continue developing. This pattern explains why PPSD's digital transformation extends beyond administrative digitalization toward the strengthening of institutional, economic, and social governance.

The main contribution of this study lies in extending the application of the Triple Helix Innovation theory to the context of Islamic Education Management. Unlike previous studies that tend to emphasize relationships among government, universities, and industry, this study demonstrates that pesantren can function as innovation actors that connect educational, entrepreneurial, community empowerment, and digital transformation functions. In this context, PPSD is not merely an object of policy or a recipient of technological support but an actor that integrates various stakeholder resources into its institutional development strategy. This finding demonstrates that digital governance in pesantren can develop sustainably when technological innovation is embedded within a collaborative ecosystem

[42] Wulan Priyanggani, Wella Syamkhotsaa, and Nadya Fitri, "Model Kolaborasi Stakeholder dalam Penguatan Efektivitas Manajemen Pendidikan: Studi pada Madrasah Aliyah Nurul Islam Tengaran," *Al-Mudarris: Jurnal Ilmiah Pendidikan Islam* 9, no. 1 (2026): 355–374, https://doi.org/10.23971/mdr.v9i1.11495

capable of generating resources, institutional capacity, and continuous organizational learning.

Technology-Based Management Innovation as an Instrument of Digital Governance

The findings indicate that the implementation of the Santri Link and Sundra SuperApp applications has not only shifted pesantren management from conventional to digital practices but has also transformed the mechanisms of organizational governance. Both platforms integrate student administration, financial transactions, communication with parents and guardians, business unit management, cooperatives, and various institutional services within a single digital ecosystem. These findings demonstrate that technological innovation at Sunan Drajat Islamic Boarding School is not merely positioned as an additional administrative tool. Rather, it functions as an instrument that connects various organizational functions that previously operated through relatively separate processes.

This integration has implications for how the pesantren manages information and performs its managerial functions. Data that were previously distributed across different administrative processes can now be consolidated through digital systems, making them more accessible, monitorable, and usable by relevant stakeholders.[43] This condition enables institutional leaders to obtain information more quickly and systematically as a basis for planning, organizing, implementation, and evaluation. Thus, the findings demonstrate a shift from administrative efficiency toward data-based management, in which technology is used not only to accelerate administrative tasks but also to support organizational control and decision-making processes.

This transformation also demonstrates that digitalization in pesantren has an organizational dimension. When educational, financial, service, and economic activities are connected through an integrated system, coordination across organizational functions becomes more structured. In this context, technology serves as a mechanism for reducing information fragmentation and strengthening connectivity among institutional units. Therefore, the success of technological innovation is not determined solely by the availability of digital applications but also by the institution's capacity to embed technology into its organizational processes and governance mechanisms.

These findings support Akram et al. (2022), who argue that the successful integration of technology in education is influenced not only by the availability of digital devices but also by an organization's ability to integrate technology into management practices and learning processes.[44] The findings are also consistent with Zuraida and Setiawan (2025), who explain that digital transformation can strengthen educational management, learning innovation,

[43] Milakovich, *Digital Governance,* 88.

[44] Akram et al., "Teachers' Perceptions of Technology Integration."

and the sustainability of Islamic education.[45] Similarly, Mubaraq et al. (2025) found that the implementation of Santri Link contributes to improving the effectiveness of educational services while strengthening students' digital and financial literacy.[46]

This study extends previous research by demonstrating that the function of technology at Sunan Drajat Islamic Boarding School goes beyond improving service efficiency. Santri Link and Sundra SuperApp have developed into digital infrastructure that connects educational functions, parent and guardian services, economic management, and organizational decision-making. In other words, the primary value of technological innovation lies in its capacity to integrate institutional functions rather than merely replacing manual procedures with digital ones.

Based on these findings, technology-based management innovation can be understood as an instrument of digital governance through three main functions: information integration, strengthened decision-making, and interconnected institutional services. These three functions are interrelated. Information integration provides more accessible and consolidated data. The availability of such data supports decision-making processes, while interconnected services enable decisions and institutional services to be implemented in a more coordinated manner. This pattern explains how digitalization at Sunan Drajat Islamic Boarding School has developed beyond administrative digitization toward the formation of a more integrated and adaptive organizational governance system.

Thus, technological innovation generates value creation for various stakeholders. For pesantren managers, technology supports administrative efficiency and decision-making. For students and parents or guardians, it improves access to institutional services and information. Meanwhile, for business units and cooperatives, digital integration expands the role of technology in supporting economic activities. These findings indicate that the value of innovation lies not merely in the technology itself but in the institution's enhanced capacity to manage information, connect organizational functions, and sustain institutional operations.

Sustainable Digital Governance in the Perspective of Islamic Education Management

The findings indicate that digital governance at Sunan Drajat Islamic Boarding School has developed through three interrelated dimensions: institutional sustainability, economic sustainability, and social sustainability. These three dimensions demonstrate that digitalization in the pesantren is not solely aimed at improving organizational efficiency, but also at strengthening

[45] Zuraida and Setiawan, "Digital Transformation in Islamic Boarding Schools."

[46] Abd. Mubaraq, Habib Ahmad Alhawari, Ahmad Mubarok, and Muhammad Naufal Rizky Ramadhan, "Model Edukasi Literasi Keuangan Digital Berbasis Santri Link dalam Mengurangi Perilaku Konsumtif Santri di Pondok Pesantren Mathla'ul Anwar Pontianak," *Journal of Research Applications in Community Service* 4, no. 4 (2025): 169–179, https://doi.org/10.32665/jarcoms.v4i4.5676

the institution's capacity to sustain its educational functions, maintain economic independence, and generate benefits for society. Thus, the digital governance developed by the pesantren has a long-term orientation that connects managerial, economic, and social aspects within an integrated institutional framework.

Institutional sustainability is realized through the development of integrated information systems, the improvement of human resource competencies, and leadership regeneration that is responsive to technological developments. The availability of digital systems enables the pesantren to maintain continuity in information management and service delivery despite changes in its management structure. Meanwhile, strengthening human resource competencies is essential to ensure that the systems already established can be continuously utilized and developed. This finding indicates that digital sustainability depends not only on technology but also on the organization's capacity to manage and develop technology on an ongoing basis.

Economic sustainability is developed through the expansion and diversification of business units supported by digital technology. The integration of technology into the management of business units and cooperatives enables economic activities to be managed in a more structured manner and connected to the pesantren's institutional system. These economic activities serve not only as sources of revenue but also support the financial independence of the pesantren in funding its educational and operational activities. This finding demonstrates that digitalization has a strategic role in strengthening the institution's economic capacity, thereby providing greater resources to sustain its educational programs.

Social sustainability is manifested through educational subsidies, scholarships for students, community empowerment, and the strengthening of networks among Islamic boarding schools. These practices demonstrate that the benefits of pesantren governance extend beyond the internal interests of the institution. Resources managed through institutional and economic systems are also directed toward expanding access to education and generating benefits for the wider community. In this context, social sustainability represents part of the pesantren's institutional responsibility in fulfilling its educational and community service functions.

These three dimensions form a mutually supportive relationship. Institutional sustainability provides the organizational capacity and human resources required to manage digital systems. Economic sustainability provides financial support for educational and institutional development. Meanwhile, social sustainability extends the benefits of the pesantren to students and the wider community. This relationship demonstrates that digital governance at Sunan Drajat Islamic Boarding School has developed as an integrated system connecting organizational capacity, economic independence, and social responsibility.

The findings also demonstrate that the orientation of digital transformation in pesantren has distinctive characteristics compared with business organizations. In business organizations, digitalization is generally associated with increased productivity, operational efficiency, and profitability. In Islamic educational institutions, however, the indicators of success have a broader scope because technology is also expected to support educational objectives, institutional sustainability, the strengthening of Islamic values, and social welfare. Therefore, the use of technology in pesantren management cannot be separated from the fundamental objectives and characteristics of pesantren as Islamic educational institutions.

From the perspective of Islamic Education Management, this condition positions technology as an instrument for strengthening governance based on the principles of amanah, transparency, accountability, justice, and service to the community. The principle of amanah relates to the responsibility of institutional managers to use resources and information appropriately. Transparency and accountability concern openness and responsibility in institutional management. Meanwhile, justice and service to the community indicate that the outcomes of pesantren management should provide equitable benefits to students, parents or guardians, managers, and the wider community.[47] Thus, technology is not positioned as an end in itself but as a means of supporting educational objectives and social welfare, which constitute important orientations in the management of Islamic educational institutions.

These findings are consistent with the concept of Digital Governance, which emphasizes technological integration, transparency, effectiveness, accountability, and participation in organizational governance. The findings also reinforce the Digital Good Governance model developed by Sutopo (2025), which demonstrates that the success of digitalization in educational institutions is influenced by an organization's ability to integrate technology with good governance principles.[48] This study extends this perspective by demonstrating that the implementation of digital governance in pesantren has a stronger ethical and religious dimension. Islamic values serve as a foundation for determining the direction of technology use, resource management, decision-making, and the distribution of institutional benefits.

Thus, sustainable digital governance at Sunan Drajat Islamic Boarding School can be understood as an institutional management process that integrates technology with institutional sustainability, economic independence, and social welfare. The perspective of Islamic Education Management provides a normative foundation that ensures digital transformation remains oriented toward educational objectives and Islamic values. These findings demonstrate that the success of digitalization in

[47] Saefrudin, *Manajemen Pendidikan Islam di Sekolah Berbasis Digitalisasi: Teori dan Praktik* (Yogyakarta: PT Cakra Pustaka Education, 2026), 13.

[48] Sutopo, "Digital Good Governance in Pesantren-Based Madrasas."

pesantren cannot be measured solely by the extent to which technology is adopted, but also by its capacity to strengthen institutional sustainability, support economic independence, and expand the benefits of education for society.

Theoretical and Practical Implications

Theoretically, this study contributes to the development of Islamic Education Management scholarship by demonstrating that digital transformation in pesantren should be understood as an institutional change process involving technology, leadership, collaboration, and governance. The Triple Helix Innovation perspective helps explain the importance of collaboration among pesantren, government, and external stakeholders in supporting institutional innovation.[49] The Transformational Leadership perspective highlights the role of leadership in establishing a vision, promoting organizational change, and mobilizing organizational resources to adapt to technological developments.[50] Meanwhile, the Digital Governance perspective explains how technology can be utilized to establish governance that is more integrated, transparent, accountable, and responsive.[51] These three perspectives demonstrate that digital transformation in pesantren cannot be explained solely in terms of technological readiness, but also needs to be examined through institutional capacity, leadership, and relationships with various stakeholders.

The findings further extend the study of digital transformation in Islamic Education Management by demonstrating that technology adoption in pesantren is shaped by the values and objectives of Islamic education. Technology is utilized to support educational management, services for students and parents or guardians, economic independence, and institutional sustainability. Therefore, digital transformation in the pesantren context needs to be situated within a governance framework that goes beyond efficiency and incorporates the principles of amanah, public benefit (maslahah), social responsibility, and the sustainability of Islamic education. This perspective contributes to the development of Islamic Education Management scholarship by positioning technology as part of organizational change and institutional governance rather than merely as an administrative tool.

Practically, this study demonstrates that digital transformation in pesantren requires an integrated strategy. Such a strategy includes the development of interconnected information systems, the improvement of human resource competencies, the strengthening of technology-oriented adaptive leadership, the development of partnership networks, the digitalization of educational services, and the use of technology in managing

[49] Etzkowitz, *The Triple Helix*, 27.

[50] Bass and Riggio, *Transformational Leadership*, 35.

[51] Milakovich, *Digital Governance*, 50.

business units. Each aspect needs to be developed according to the capacity, needs, and characteristics of each pesantren. The experience of Sunan Drajat Islamic Boarding School demonstrates that technological development can be directed toward supporting multiple institutional functions simultaneously, ensuring that the benefits of digitalization extend beyond administrative efficiency.

The findings also provide practical lessons for other pesantren that seek to sustain their digital transformation. Pesantren need to develop human resources capable of operating and improving digital systems, establish clear data management mechanisms, strengthen collaboration with external stakeholders, and develop funding sources that can support the continuity of institutional innovation. In this context, technology-enabled business units can serve as one strategy for strengthening economic independence while supporting the financing of institutional development.

Thus, the digital transformation model implemented by Sunan Drajat Islamic Boarding School can serve as a reference for other pesantren in designing digital governance according to their institutional needs and characteristics. The model demonstrates that digitalization can be directed toward connecting educational, service, economic, and governance functions within an integrated institutional ecosystem. Its implementation, however, requires adaptation to each pesantren's resources, organizational structure, institutional culture, and objectives so that digital transformation can develop in an adaptive, transparent, accountable, and sustainable manner.

Conclusion

This study demonstrates that digital transformation at Sunan Drajat Islamic Boarding School in Lamongan is an organizational change process involving visionary leadership, technological innovation, and cross-stakeholder collaboration. The implementation of Santri Link and Sundra SuperApp integrates administration, educational services, financial transactions, communication with parents or guardians, and business unit management within a single digital ecosystem. Digitalization has not only improved administrative efficiency but also strengthened transparency, accountability, data-based decision-making, economic independence, and the quality of educational services.

This study contributes by demonstrating that digital transformation in pesantren can be understood through the interconnection of Triple Helix Innovation, Transformational Leadership, and Digital Governance grounded in Islamic values. The digital governance developed also encompasses institutional, economic, and social sustainability. These findings can serve as a reference for other pesantren in developing digital transformation according to their institutional characteristics. Future research should employ comparative or mixed-method approaches across different types of pesantren to gain broader insights into digital transformation models in Islamic Education Management.

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