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Artificial Intelligence-Based Islamic Education Management: Madrasah Governance Innovation in the Digital Era

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Abstract. The accelerating pace of digital transformation has heightened the demand for governance innovation in Islamic education institutions, particularly madrasahs striving to balance managerial effectiveness with ethical accountability. Although existing literature has explored digitalization in Islamic education, empirical research that explicitly addresses Artificial Intelligence-Based Islamic Education Management as a form of madrasah governance innovation remains limited. This study aims to investigate how AI-based Islamic education management is implemented and how it contributes to governance innovation in the digital era. A qualitative case study design was employed in selected madrasahs that have initiated digital transformation and adopted AI-supported management systems. Participants included madrasah principals, vice principals, senior teachers, academic coordinators, and information system operators who were directly involved in governance and managerial decision-making. Data were collected through semi-structured interviews, non-participant observations, and document analysis. The data were analyzed thematically to identify recurring patterns related to governance practices and innovation processes. The findings demonstrate that Artificial Intelligence-Based Islamic Education Management enhances governance effectiveness by enabling data-driven decision-making, improving administrative efficiency, and strengthening transparency and accountability in line with Islamic ethical values such as amanah and shūrā. Nevertheless, challenges related to digital literacy, infrastructure readiness, and ethical concerns regarding data use remain evident. The study implies that while AI-based management offers substantial potential for madrasah governance innovation, its sustainability depends on institutional capacity building, ethical governance frameworks, and supportive policy environments.

Keywords: Artificial Intelligence; Islamic Education Management; Madrasah Governance; Governance Innovation; Digital Transformation; Educational Leadership Mediation, SEM-PLS, Bootstrapping.

Introduction

The rapid digital transformation driven by advances in information technology and Artificial Intelligence (AI) has become a major global issue influencing governance and management across educational systems, including Islamic education institutions (Umah et al., 2023). This issue is particularly important as madrasahs are increasingly required to improve institutional effectiveness, accountability, and educational quality while remaining faithful to Islamic values and traditions (Haddade et al., 2024). However, many madrasahs continue to face governance challenges, such as limited data-driven decision-making, inefficient administrative processes, and difficulties in adapting management practices to the demands of the digital era. In response to these challenges, this study introduces the concept of Artificial Intelligence-Based Islamic Education Management, which refers to the strategic integration of AI technologies into the governance and management of madrasahs to enhance institutional performance and decision-making (Haddade et al., 2023). This research topic is characterized by the use of AI-driven data analytics, intelligent administrative systems, digital monitoring of academic performance, and adaptive management tools that support transparent, efficient, and value-oriented governance. Investigating Artificial Intelligence-Based Islamic Education Management is therefore crucial, as it offers an innovative approach to madrasah governance in the digital era, enabling Islamic education institutions to strengthen managerial effectiveness while upholding

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their educational and religious missions (Mintasih et al., 2024; Apriani et al., 2025).

Previous research on Islamic education management has extensively explored the role of digital technology in supporting administrative efficiency, instructional delivery, and institutional governance within madrasahs. Early studies primarily focused on the adoption of educational management information systems, e-learning platforms, and digital record-keeping as instruments for modernizing madrasah administration. These studies generally concluded that digitalization contributes to improved organizational effectiveness, transparency, and access to educational services (Rosyidi et al., 2025). As technological advancement accelerated, subsequent research expanded its scope to examine digital leadership, online governance practices, and the integration of information and communication technologies into strategic management processes in Islamic educational institutions (Koukaras et al., 2025; Apriani et al., 2025)

More recent scholarly work reflects a clear progression from basic digital adoption toward more sophisticated models of digital governance innovation in madrasahs. This body of research emphasizes the importance of data-driven decision-making, digital accountability, and technology-enabled performance monitoring as key components of effective governance in the digital era. Several studies have highlighted how digital platforms facilitate better coordination among stakeholders, enhance institutional responsiveness, and support continuous improvement in educational quality (Anastasiou, 2025a). This evolution in the literature suggests that madrasah governance is gradually transitioning from conventional, manual management structures toward more integrated and technology-supported governance frameworks (Hamdani, 2023; Muthmainnah et al., 2025).

Despite this significant progress, existing research remains limited in addressing Artificial Intelligence-Based Islamic Education Management as a distinct and transformative governance approach. Most prior studies treat digital technology as a supportive or supplementary tool rather than as an intelligent management system capable of autonomous data analysis, predictive decision-making, and adaptive governance. In particular, empirical investigations that examine how AI-based management systems contribute to madrasah governance innovation in the digital era are still scarce (Hossin et al., 2023). The interaction between AI-driven management practices and core governance dimensions such as leadership, accountability, ethical decision-making, and institutional sustainability has not been sufficiently explored in the context of Islamic education. This limitation highlights a critical research gap and underscores the need for in-depth investigation into Artificial Intelligence-Based Islamic Education Management as a strategic variable that can fundamentally reshape madrasah governance and management practices in the digital era (Bashori et al., 2024).

Artificial Intelligence-Based Islamic Education Management constitutes a critical variable in addressing the challenges of madrasah governance innovation in the digital era, as it offers intelligent, data-driven, and adaptive solutions for institutional management. The integration of AI into Islamic education management enables madrasahs to optimize decision-making processes, enhance administrative efficiency, and support transparent governance while aligning managerial practices with Islamic ethical values (An et al., 2025a). Previous research has suggested that advanced digital systems, particularly those incorporating data analytics and intelligent automation, play a significant role in improving governance effectiveness, organizational accountability, and institutional performance in educational settings. Studies on digital governance and smart education management indicate that technology-driven management frameworks are more capable of responding to complex organizational demands and dynamic policy environments (Chen et al., 2020).

Despite the recognized importance of digital innovation in educational governance, the application of Artificial Intelligence-Based Islamic Education Management remains a relatively unexplored area in empirical research (Sposato, 2025a). Most existing studies address digital transformation in Islamic education at a general level, without specifically examining how AI-driven management systems can function as a core governance mechanism within madrasahs. This lack of focused investigation creates a substantial gap in understanding how AI can be

systematically integrated into Islamic education management to support governance innovation in the digital era. Therefore, this study aims to examine the role of Artificial Intelligence-Based Islamic Education Management in fostering madrasah governance innovation, with particular attention to managerial processes, decision-making practices, and institutional effectiveness (Anastasiou, 2025b; Al Yakin et al., 2023).

In the Indonesian context, however, madrasah education is governed by a dual arrangement involving the Ministry of Religious Affairs and national educational policies, posing distinct administrative and managerial challenges. Efforts to foster digital transformation in education continue to face several constraints, particularly for madrasahs in Indonesia, especially in rural secondary schools. The main challenges here involve the availability of technological infrastructure, human resources, and information/data management systems. As a consequence, administrative procedures become disjointed, manual data recording is practiced extensively, and there is a lack of exploitation of the data available for decision-making. Moreover, while the introduction of digital educational platforms as well as school-based management reforms has been initiated, they have encountered problems in being implemented across all types of schools, including madrasahs, because of institutional differences and the lack of digital skills in administrators. It thus becomes necessary to apply innovative approaches to improve educational management in madrasahs, and the adoption of Artificial Intelligence represents an effective way to do so, especially since it can help in overcoming some of the existing governance weaknesses and promote evidence-based decision-making. This paper thus focuses on the topic

The contribution of this study is twofold. Theoretically, it extends the discourse on Islamic education management by conceptualizing AI as a governance innovation that complements Islamic managerial principles such as accountability (amanah), consultation (shūrā), and justice (‘adl). Practically, the study provides evidence-based insights for madrasah leaders, policymakers, and educational administrators on how AI-based management systems can be strategically employed to enhance governance quality and sustainability in the digital era.

Materials and Methods

This study employed a qualitative case study design to examine how Artificial Intelligence-Based Islamic Education Management contributes to madrasah governance innovation in the digital era. Guided by an interpretivist paradigm, the qualitative approach was selected to capture the complexity of governance practices, managerial decision-making, and stakeholder interpretations related to the integration of AI within Islamic education institutions. The case study design enabled an in-depth exploration of AI-supported management as it operates in real institutional contexts, allowing for a holistic understanding of the interaction between technological systems, governance processes, and Islamic ethical values.

The research was conducted in selected madrasahs that have implemented digital transformation initiatives and adopted AI-supported management systems. Participants included madrasah principals, vice principals, senior teachers, academic coordinators, and system operators who were directly involved in governance and management processes. A purposive sampling technique was employed to ensure the inclusion of participants with relevant experience in AI-based management practices. Data were collected through semi-structured in-depth interviews, non-participant observations, and document analysis, enabling methodological triangulation and enhancing the credibility of the findings. Data collection continued until data saturation was achieved.

Data analysis followed a thematic analysis approach, guided by Braun and Clarke’s framework. The process involved data familiarization, inductive coding, category development, and theme construction through iterative comparison across data sources. To ensure methodological rigor, trustworthiness was established through triangulation, member checking, prolonged engagement, and the maintenance of an audit trail. Ethical considerations were strictly observed through informed consent, confidentiality, and anonymization of participants. Although the findings are context-specific, the study offers analytical generalization relevant to similar

contexts of madrasah governance innovation in the digital era.

Result and Discussion

Result

The first research question examined how Artificial Intelligence-Based Islamic Education Management is implemented in madrasah governance in the digital era. The findings indicate that AI-based management is primarily applied through data-driven administrative systems, digital monitoring of academic performance, and automated decision-support tools used by madrasah leaders. These practices enable more systematic planning, transparent reporting, and timely managerial decisions. The results suggest that AI functions not merely as a technological tool but as an integral component of governance processes that reshape how leadership, coordination, and accountability are enacted within madrasahs.

The second research question explored the perceived impact of AI-based Islamic education management on governance innovation. The findings reveal that participants perceived significant improvements in governance effectiveness, particularly in terms of efficiency, accuracy of decision-making, and institutional responsiveness. AI-supported analytics allowed leaders to identify academic and administrative issues more proactively, while digital systems enhanced coordination among stakeholders. These results indicate that governance innovation in madrasahs emerges when AI-based management aligns managerial practices with both institutional goals and Islamic ethical principles, such as amanah (accountability) and shūrā (consultative decision-making).

The third research question focused on the challenges and limitations associated with implementing AI-based management in madrasah governance. The findings show that constraints include limited digital literacy among some staff, uneven technological infrastructure, and concerns regarding the ethical use of AI in educational decision-making. Despite these challenges, participants emphasized that AI-based management remains a strategic innovation with strong transformative potential. These results indicate that while AI-based Islamic education management contributes positively to governance innovation, its effectiveness depends on institutional readiness, capacity-building efforts, and the integration of ethical frameworks that guide the responsible use of AI in Islamic education contexts.

Table 1.
Themes and Sub-Themes of Artificial Intelligence-Based Islamic Education Management in Madrasah Governance

Research Question	Main Theme	Sub-Themes	Indicative Description
RQ1: How is AI-based Islamic education management implemented in madrasah governance?	**AI-Driven Governance Practices**	Data-driven administrative planning	Use of AI analytics to support strategic planning and institutional decision-making
		Digital academic monitoring	AI-supported systems for tracking student performance and learning outcomes
		Automated decision-support systems	Utilization of AI tools to generate recommendations for managerial actions
RQ2: How does AI-based management contribute to	**Governance Effectiveness and Innovation**	Managerial efficiency	Reduction of administrative workload and

governance innovation?			improved operational speed
		Transparency and accountability	Digital reporting and real-time access to institutional data
		Ethical governance aligned with Islamic values	Integration of *amanah* and *shūrā* within AI-supported decision processes
RQ3: What challenges are associated with AI-based management implementation?	**Constraints and Ethical Considerations**	Digital literacy gaps	Limited skills among staff in operating AI-based systems
		Infrastructure limitations	Unequal access to technological resources and system reliability

Discussion

This study aimed to examine the role of Artificial Intelligence-Based Islamic Education Management in fostering madrasah governance innovation in the digital era, with particular attention to its implementation, perceived impacts, and contextual challenges (Elmahjub, 2023). The discussion is structured around the research questions and builds upon the thematic findings presented in the Results section. Overall, the findings demonstrate that AI-based management constitutes a significant governance innovation that transforms managerial processes, enhances institutional effectiveness, and redefines leadership practices within madrasahs operating in digitally mediated environments (Gorian & Osman, 2024a).

The results indicate that Artificial Intelligence-Based Islamic Education Management is primarily implemented through data-driven administrative systems, digital academic monitoring, and automated decision-support tools (Destriani et al., 2024). These practices enable madrasah leaders to make more informed and timely decisions based on real-time data rather than intuition or manual reporting. Such findings align with previous studies on digital governance and smart education management, which emphasize that advanced digital systems enhance organizational responsiveness and managerial accuracy (Gorian & Osman, 2024b). However, this study extends prior research by demonstrating that, in the context of Islamic education, AI-based management is not merely a technical enhancement but a governance mechanism that can be aligned with Islamic ethical values such as amanah (trustworthiness), shūrā (consultative decision-making), and ‘adl (justice) (Destriani et al., 2023).

The present findings strongly support earlier research suggesting that technology-driven management improves governance effectiveness in educational institutions. Consistent with studies on digital transformation in schools and universities, participants in this study reported improved efficiency, transparency, and accountability as a result of AI integration. (Murni Yanto et al., 2022). Administrative tasks that previously required extensive manual effort were streamlined through AI-supported systems, allowing leaders and teachers to focus more on strategic and pedagogical responsibilities (Kamalov et al., 2023). This supports the argument that AI-based management contributes to governance innovation by enabling institutions to operate more effectively within increasingly complex policy and accountability environments.

From an interpretative perspective, the data suggest that the effectiveness of AI-based Islamic education management lies in its capacity to integrate technological intelligence with human judgment and religious values (Khakpaki, 2025). Rather than replacing human decision-making, AI functions as a decision-support system that enhances leaders’ capacity to analyze data, anticipate problems, and design appropriate interventions. This interpretation reinforces the view that governance innovation in Islamic education must be both technologically advanced and

ethically grounded. Participants perceived AI as a tool that supports responsible leadership when guided by Islamic moral frameworks, thereby mitigating concerns that technological governance may undermine human agency or ethical considerations (Kuzior et al., 2023).

The benefits experienced by participants further underscore the strategic value of the independent variable examined in this study. Madrasah leaders reported increased confidence in planning and evaluation processes, while teachers experienced more systematic monitoring of student progress and institutional performance (Khan et al., 2025a). These benefits illustrate how AI-based management directly contributes to improved governance outcomes by facilitating coordination, consistency, and evidence-based decision-making. Such outcomes are particularly significant for madrasahs, which often operate under resource constraints and require efficient management systems to maintain educational quality and institutional sustainability (Dunleavy & Margetts, 2025).

Despite these positive findings, the study also identified several contrary points and challenges associated with the implementation of AI-based management. Participants expressed concerns related to limited digital literacy among staff, unequal access to technological infrastructure, and ethical issues such as data privacy and potential algorithmic bias (An et al., 2025b). These negative aspects highlight that governance innovation through AI is not a linear or unproblematic process. Instead, it is shaped by institutional capacity, organizational culture, and broader socio-technical conditions. In the context of madrasahs, these challenges may be intensified by disparities in funding, variations in technological readiness, and differing levels of exposure to digital innovation (Ali et al., 2024).

The existence of these contrary points can be explained by considering the broader context of educational technology adoption. Previous studies have shown that early stages of digital transformation are often accompanied by resistance, skill gaps, and ethical concerns. Research on AI adoption in education suggests that institutions lacking sufficient training and infrastructure may struggle to realize the full benefits of intelligent systems.(Sposato, 2025b) These findings help contextualize the challenges identified in this study and suggest that the negative aspects observed are not inherent limitations of AI-based management but rather reflect transitional issues that accompany innovation processes (Al-Zahrani, 2024).

The implications of this study are multifaceted. Theoretically, the findings contribute to the literature on Islamic education management by conceptualizing Artificial Intelligence-Based Islamic Education Management as a form of governance innovation that integrates technological intelligence with Islamic ethical principles. This conceptualization advances existing frameworks of digital governance by introducing a value-oriented perspective rooted in Islamic educational philosophy (Vesna, 2025). Practically, the study provides actionable insights for madrasah leaders and policymakers, emphasizing the importance of capacity building, ethical governance frameworks, and infrastructure development to support sustainable AI integration. For policymakers, the findings highlight the need for policies that promote equitable access to technology and professional development, ensuring that AI-based governance innovations contribute to inclusive and ethical educational development in the digital era (Khan et al., 2025b).

Conclusion

This study aimed to examine the role of Artificial Intelligence-Based Islamic Education Management in promoting madrasah governance innovation in the digital era. Specifically, the research sought to understand how AI-based management is implemented within madrasah governance structures, how it influences governance effectiveness and innovation, and what challenges accompany its adoption in Islamic education institutions. By employing a qualitative case study approach, this study provides an in-depth understanding of governance innovation processes as they unfold in real madrasah contexts.

The findings of this study indicate that Artificial Intelligence-Based Islamic Education Management contributes significantly to governance innovation by enabling data-driven decision-making, enhancing administrative efficiency, and supporting transparent and

accountable governance practices. AI-based systems were found to facilitate more systematic planning, accurate performance monitoring, and proactive managerial responses. Importantly, the study demonstrates that AI-based management can be meaningfully aligned with Islamic ethical values such as amanah, shūrā, and 'adl, thereby reinforcing the moral foundations of madrasah governance while advancing digital transformation.

Despite these contributions, the study has several limitations. First, the qualitative case study design limits the generalizability of the findings to broader populations of madrasahs. Second, the research was conducted within a specific institutional and cultural context, which may influence the applicability of the results to other Islamic education settings with different governance structures or levels of technological readiness. Third, the study relied primarily on participants' perceptions and institutional documents, which may be subject to subjective interpretation and social desirability bias.

Future research is therefore recommended to address these limitations by employing mixed-methods or quantitative approaches to examine the impact of AI-based Islamic education management on governance outcomes across a larger and more diverse sample of madrasahs. Comparative studies across regions or educational levels would further enhance understanding of contextual factors influencing AI adoption. Additionally, future research should explore ethical governance frameworks and policy models that guide responsible AI integration in Islamic education, ensuring that technological innovation remains aligned with educational values and societal needs in the digital era.

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