

Digital Maturity and School Effectiveness Management in Islamic Boarding Institutions: A Comparative Literature Review of Indonesia, Malaysia, Pakistan, and Turkey (2022–2025)

Abdul Kafi^{1*}, Muhammad Syarif², Sutikno³
Universitas Trunojoyo Madura Indonesia

Corresponding Author: Abdul Kafi kafi43777@gmail.com

ARTICLE INFO

Keywords: digital maturity, School Effectiveness Management, Islamic boarding school, pesantren, Imam Hatip

Received : 09, June

Revised : 12, July

Accepted: 30, August

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ABSTRACT

This comparative literature review examines the intersection of digital maturity and School Effectiveness Management (SEM) in Islamic boarding institutions—including pesantren, madrasah berasrama, Imam Hatip schools, and Islamic residential schools—across Indonesia, Malaysia, Pakistan, and Turkey. The findings reveal a pronounced variance in digital maturity levels: Turkey demonstrates the most advanced systemic integration through its FATIH Project and EBA platform; Malaysia exhibits structured policy-driven progress via the Digital Education Policy (2023) and DELIMA; Indonesia shows wide heterogeneity ranging from emerging to developing stages, heavily dependent on Kyai leadership and institutional typology; and Pakistan remains at the earliest stages, hampered by infrastructure deficits and inconsistent madrasah reform implementation. Regarding SEM, all four countries share common dimensions of instructional leadership, stakeholder engagement, and curriculum integration, yet the operationalization differs markedly according to religio-cultural governance structures.

INTRODUCTION

Islamic boarding institutions occupy a distinctive niche in the global educational landscape, combining residential living with an integrated religious-secular curriculum under the spiritual guidance of religious leaders (Hasan, 2023; Nurwahidin et al., 2023). Known variously as *pesantren* in Indonesia, *Sekolah Menengah Kebangsaan Agama* (SMKA) and Islamic boarding schools in Malaysia, *madrasah* networks in Pakistan, and *Imam Hatip* schools in Turkey, these institutions collectively serve millions of students and play an instrumental role in shaping the intellectual, moral, and spiritual development of Muslim youth (Sidik, 2024; Setiaji, 2024). In the Society 5.0 era, where artificial intelligence, big data, and digital ecosystems are redefining how organizations operate, these institutions face a dual imperative: preserving their religio-cultural identity while embracing digital transformation to remain relevant and competitive (Calista, 2025; Mukarromah et al., 2025).

The COVID-19 pandemic (2020–2021) proved to be the critical inflection point for digitalization in Islamic boarding education. The sudden lockdowns and mandatory distance learning forced institutions that had historically resisted technological adoption to rapidly implement digital solutions—ranging from basic messaging applications to sophisticated Learning Management Systems (LMS)—in order to maintain educational continuity (Nurwahidin et al., 2023; Jamil & Muschert, 2023). This pandemic-induced digital acceleration forms the baseline for the present study, which examines the trajectory of digital maturity and its relationship to School Effectiveness Management (SEM) in the post-pandemic period of 2022–2025.

Despite growing scholarly interest in both digitalization and management effectiveness within Islamic educational institutions, a significant gap persists in the literature: comparative cross-national studies that explicitly examine "digital maturity" as a construct and its nexus with SEM implementation remain exceedingly rare. Most existing research is single-country, single-institution focused, and rarely employs systematic frameworks for assessing digital maturity or school effectiveness in Islamic boarding contexts (Wajdi et al., 2024; Tantowi, 2025).

THEORETICAL REVIEW

Digital Maturity in Educational Institutions

Digital maturity refers to the degree to which an institution systematically leverages digital technologies across its strategy, structures, processes, human resources, culture, and service delivery (Bravo-Jaico et al., 2025; Đurek et al., 2019). Unlike digital readiness, which captures a snapshot of preparedness, digital maturity implies an evolutionary trajectory through identifiable stages. Recent scholarship has proposed multi-dimensional models for assessing digital maturity in educational settings. The framework developed by Bravo-Jaico et al. (2025) for higher education institutions identifies eight dimensions organized around four key components of digital transformation and four relevant actor categories. Similarly, the model proposed for Indonesian vocational schools by the study published in *Jurnal Pendidikan Vokasi* comprises five dimensions—strategy and organization, people and culture, products and services, technology

and infrastructure, and organizational operations—with five maturity levels ranging from "not ready" to "fully applied" (Digital Maturity Models, 2025). The Jisc Digital Assessment Maturity Model (2023) from the United Kingdom provides another reference with five progressive stages: approaching and understanding, experimenting and exploring, operational, embedded, and transformational.

For Islamic boarding institutions, the application of digital maturity frameworks requires contextual adaptation. The unique governance structure—where a *Kyai* (Indonesia), *Mudir* (Malaysia/Pakistan), or *Hoca* (Turkey) serves simultaneously as spiritual, administrative, and educational leader—significantly influences technology adoption trajectories (Bahri et al., 2024; Hasan, 2023). Religious values, communal living arrangements, and the primacy of oral textual traditions (e.g., *Kitab Kuning* study in pesantren) create both distinctive opportunities and resistances to digitalization (Nurwahidin et al., 2023).

School Effectiveness Management (SEM)

School Effectiveness Management (SEM) constitutes the integrated application of leadership, governance, curriculum management, instructional quality, school climate, monitoring and evaluation, stakeholder engagement, and student achievement orientation within an institution (School Effectiveness Framework, 2010; Saga, 2025). The School Effectiveness Framework identifies key elements including leadership, working with others, networks of professional practice, intervention and support, improvement and accountability, and curriculum and teaching—each contributing to improved learning and wellbeing when implemented in an integrated manner (School Effectiveness Framework, 2010).

In the context of Islamic boarding institutions, SEM acquires additional dimensions. The role of the *Kyai* or religious leader extends beyond conventional instructional leadership to encompass religio-cultural authority, spiritual mentoring, and community stewardship (Bahri et al., 2024; Norman et al., 2025). Curriculum management must navigate the integration of *diniyah* (religious sciences) with formal national curricula, a challenge documented across all four countries (Sidik, 2024; Yolanda et al., 2025). Dormitory management and character formation through 24-hour communal living add layers of complexity absent from conventional school effectiveness models (Permana, 2024; El-Yunusi, 2025).

The Digital Maturity-SEM Nexus

The conceptual link between digital maturity and SEM rests on the premise that digitally mature institutions are better positioned to implement data-driven decision-making, transparent governance, efficient administrative processes, and enhanced pedagogical delivery—all core components of effective school management (Tantowi, 2025; Saepurohman et al., 2025). Education Management Information Systems (EMIS), LMS platforms, digital assessment tools, and communication technologies serve as enablers that amplify the effectiveness of leadership, curriculum delivery, and stakeholder engagement.

Conversely, low digital maturity—characterized by inadequate infrastructure, limited digital literacy among staff, and absence of strategic digital policies—constrains the potential for SEM implementation (Wajdi et al., 2024; Ghani et al., 2024).

Country Contexts

Indonesia hosts the world's largest network of pesantren, with over 27,000 registered institutions ranging from traditional *salafiyah* (focused exclusively on classical Islamic texts) to modern *khalafiyah* (integrating formal national curriculum). Government digitalization policies, including the national broadband initiative and Merdeka Belajar (Freedom to Learn) framework, have accelerated technology adoption, though significant disparities persist between urban and rural pesantren (Hasan, 2023; Novebri et al., 2025).

Malaysia operates a structured system of government-aided Islamic religious schools, including SMKA, Sekolah Agama Bantuan Kerajaan (SABK), and private Islamic boarding schools. The Malaysia Education Blueprint 2013–2025 and the National Digital Education Policy (2023) provide a strong policy foundation for ICT integration, supported by platforms such as DELIMa and national broadband infrastructure, though rural implementation gaps remain (Malaysia Education Blueprint, 2023; ISIS Malaysia, 2023; Mohd Zin et al., 2023).

Pakistan possesses a vast and diverse madrasah system estimated at over 35,000 institutions, operating largely outside the formal regulatory framework. Post-COVID reforms have introduced digital initiatives such as the TeleSchool App, eTaleem Portal, and Smart Classroom projects, but implementation faces formidable barriers including infrastructure deficits, ideological resistance, and inconsistent regulatory oversight (Ministry of Federal Education and Professional Training, 2023; Sattar, 2024; Jamil & Muschert, 2023).

Turkey has pursued systematic educational technology integration through the FATIH (Movement to Enhance Opportunities and Improve Technology) Project since 2011, deploying interactive whiteboards, tablet computers, and the EBA (Education Information Network) platform across all school types, including Imam Hatip schools. Under the AKP government, Imam Hatip schools have expanded dramatically—from 2% to over 12% of secondary enrollment—and have been positioned as flagship institutions combining religious and secular education with modern technology infrastructure (EBA Wikipedia, 2020; Kurnaz, 2025; World Bank, 2023; Bestari, 2026).

METHODOLOGY

Research Design

This study employs a Comparative Systematic Literature Review (CSLR) approach, combining the rigor of systematic review methodology with explicit cross-national comparative analysis. The design follows a protocol adapted from PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, modified to accommodate the comparative structure.

Data Sources and Search Strategy

Literature was identified from multiple databases: Scopus, Web of Science, Google Scholar, DOAJ, and national indexing systems including SINTA (Indonesia), myJurnal (Malaysia), HEC Pakistan Journals, and DergiPark/TÜBİTAK (Turkey). The search was conducted between October 2025 and January 2026, covering publications from January 2022 through December 2025.

Search terms were organized in three clusters, combined using Boolean operators:

1. **Cluster 1 (Institution type):** "Islamic boarding school" OR "pesantren" OR "madrasah" OR "Imam Hatip" OR "Islamic residential school" OR "SMKA" OR "Islamic seminary"
2. **Cluster 2 (Digital dimension):** "digitalization" OR "digital transformation" OR "ICT" OR "e-learning" OR "digital maturity" OR "digital literacy" OR "LMS" OR "technology integration"
3. **Cluster 3 (Management/effectiveness):** "school effectiveness" OR "school management" OR "quality management" OR "educational leadership" OR "school improvement" OR "institutional governance"
4. Searches were conducted for each country by adding country-specific terms (Indonesia, Malaysia, Pakistan, Turkey/Türkiye).

Inclusion and Exclusion Criteria

Inclusion criteria:

1. Peer-reviewed journal articles, conference proceedings, and research reports published between 2022 and 2025
2. Focus on Islamic boarding/residential educational institutions
3. Address at least one dimension of digitalization/ICT and/or school management/effectiveness
4. Empirical studies (qualitative, quantitative, or mixed-methods) or substantive conceptual/review articles
5. Published in English, Indonesian, Malay, Urdu, or Turkish

Exclusion criteria:

1. Studies focusing exclusively on non-boarding Islamic institutions (day schools, non-residential madrasah) unless part of a boarding system
2. Opinion pieces, editorials, or news reports without systematic research methodology
3. Duplicate publications or pre-prints of already included final versions

Selection Process and Final Corpus

The identification yielded 247 initial records. After removing 43 duplicates, 204 records were screened by title and abstract, resulting in 119 articles passing initial relevance criteria. Full-text assessment of these 119 articles against the inclusion criteria yielded a final corpus of 62 articles: Indonesia (n = 28), Malaysia (n = 11), Pakistan (n = 12), and Turkey (n = 11).

Data Analysis

Each article was coded along the following dimensions: (a) country and institutional type; (b) methodological approach; (c) digital maturity indicators (infrastructure, LMS/platform adoption, digital literacy, digital policy, leadership for digital innovation); (d) SEM dimensions addressed (leadership, curriculum, school climate, monitoring/evaluation, stakeholder engagement, student outcomes); and (e) key findings and challenges. Thematic analysis was performed within each country, followed by cross-national comparative analysis. A qualitative maturity classification (Emerging, Developing, Established, Advanced) was applied based on the aggregated indicators from the literature.

RESULTS AND DISCUSSION

Profile of Reviewed Literature

The 62 articles reviewed demonstrate a predominantly qualitative methodological orientation (67.7%), followed by mixed-methods designs (19.4%) and quantitative studies (12.9%). Indonesia contributes the largest proportion of studies (45.2%), reflecting both the sheer scale of its pesantren system and robust domestic publication ecosystems indexed in SINTA. Turkish sources primarily emerge from education technology and religious education journals, while Malaysian and Pakistani studies are more dispersed across multidisciplinary outlets.

The dominant research foci are: digital transformation processes and challenges (38.7%), educational leadership and quality management (25.8%), curriculum integration (19.4%), and digital literacy assessment (16.1%).

Digital Maturity by Country

Indonesia: Emerging to Developing

The literature consistently characterizes Indonesian pesantren as exhibiting wide variance in digital maturity, heavily conditioned by institutional typology and leadership orientation. Hasan (2023) documented that *Kiai* in Madura pesantren have moved from initial resistance to positive engagement with digital transformation, though implementation remains uneven. Critically, infrastructure remains a primary bottleneck: a systematic review of 50 publications (2021–2025) on pesantren economic digitalization found that only approximately 40% of pesantren in West Java possess stable internet connections, with much hardware being outdated and insufficient (Critical Analysis of Digital Infrastructure, 2025).

Modern pesantren demonstrate more advanced adoption. The comparative case study of three Vocational High School Boarding Schools (2022–2025) identified four dimensions of digital transformation: digital policy and infrastructure, capacity building for teachers and students, technology integration in curricula, and strengthening digital employability skills (Dimyathi et al., 2025). Applications such as E-Santren and digital learning platforms have enhanced management efficiency (Wajdi et al., 2024). The study on digital literacy management in Tasikmalaya pesantren reported significant influence of structured digital literacy programs on student outcomes, with R-squared values of 0.543 and 0.760 (Saepurohman et al., 2025).

However, persistent challenges include limited technology access, inadequate infrastructure, insufficient technological skills among educators, resistance to change, and funding constraints (Tantowi, 2025). The Kyai's role is documented as pivotal: Bahri et al. (2024) found that Kyai advocacy for technology directly facilitates the transformation of educational services, including online registration, digital communication platforms, and transparent administrative processes. A digital maturity model specifically developed for Indonesian vocational schools proposed five dimensions with validated instruments (Cronbach's Alpha = 0.935), offering a transferable assessment framework (Digital Maturity Models, 2025).

Qualitative maturity classification: Emerging to Developing (wide heterogeneity; modern/khalafiyah pesantren approach Developing; traditional/salafiyah remain at Emerging stage).

Malaysia: Developing to Established

Malaysia's Islamic boarding school sector benefits from a more structured policy ecosystem. The Malaysia Education Blueprint 2013–2025 established ICT integration as a strategic priority across all school types, including SMKA and religious schools (Malaysia Education Blueprint, 2023). The National Digital Education Policy (2023) further mandated digital literacy enhancement for both students and educators, quality improvement in digital education, and infrastructure modernization (ISIS Malaysia, 2023).

The DELIMa (Digital Educational Learning Initiative Malaysia) platform, launched during the pandemic, provides centralized digital learning resources. However, post-pandemic assessments reveal implementation disparities: not all students benefited equitably, particularly in rural and underserved areas where digital devices did not reach eligible recipients (ISIS Malaysia, 2023). The Penang Institute's bridging study noted persistent challenges from "policy fragmentation, inconsistent execution at the ground level, infrastructure gaps in rural areas, and teacher readiness" (Penang Institute, 2025).

Mohd Zin et al. (2023) assessed the readiness and implications of digital application in Islamic education in Sarawak, finding that despite initial resistance, the COVID-19 pandemic made digitalization obligatory, with potential for sustained adoption post-pandemic if modified to current needs. Comparative research on religious digital literacy in Indonesia and Malaysia found that both countries utilize ICT media relying on internet access and social media, though equity challenges persist in regions unable to reach optimal internet access (Ashari, 2023).

Qualitative maturity classification: Developing to Established (strong policy frameworks and national platforms exist; implementation uneven between urban and rural).

Pakistan: Emerging

Pakistan's madrasah system presents the most challenging landscape for digital maturity. The dual education system—where madrasahs operate largely parallel to the formal sector—means that many institutions lack regulatory frameworks mandating technology adoption (Sattar, 2024). The COVID-19

pandemic exposed a severe digital divide: Jamil and Muschert (2023) documented that students from rural and remote areas experienced severe challenges due to inadequate internet access and ICT skills.

Government initiatives have introduced notable digital infrastructure. The Ministry of Federal Education launched the TeleSchool App (63,750 registered users including 9,171 out-of-school children), the eTaleem Portal with LMS and Virtual Teachers Training Institute, and 400 smart classrooms across federal territories (Ministry of Federal Education and Professional Training, 2023). However, these initiatives primarily target formal sector schools; their penetration into the madrasah system remains limited.

Barriers to ICT integration in Pakistani secondary schools are extensively documented: inadequate infrastructure, limited access to technology, insufficient teacher training, and resistance from madrasah authorities (Ghani et al., 2024; Sain et al., 2024). Madrasah reform efforts have aimed at standardizing curricula and incorporating modern subjects, but implementation has been "inconsistent and met with resistance from madrasa authorities," with significant variation across different madrasah networks (Sattar, 2024). Hassan et al. (2024) confirmed that while educators hold favorable perceptions of ICT, institutional capacity to implement remains critically deficient.

Qualitative maturity classification: Emerging (nascent government platforms; madrasah system largely undigitized; severe infrastructure and regulatory gaps).

Turkey: Established to Advanced

Turkey represents the most systematically digitized Islamic education environment among the four countries. The FATİH Project, initiated in 2011 by the Ministry of National Education, constitutes one of the world's largest educational technology endeavors, deploying interactive whiteboards and enhancing internet infrastructure across all K-12 schools, including Imam Hatip institutions (Kurnaz, 2025; EBA Wikipedia, 2020). The EBA (Education Information Network) serves as a comprehensive social learning platform offering e-content and course materials, which was significantly expanded during COVID-19 when TRT EBA TV was launched as a broadcast education service (EBA Wikipedia, 2020).

Post-pandemic, Turkey has further advanced its digital education ecosystem. The Türkiye Century Education Model integrates AI-driven platforms such as the Individual Learning Platform (MEBİ), which personalizes education using artificial intelligence. Innovation labs equipped with 3D printers and virtual reality tools are being established across schools (Yeni Şafak, 2026). The ETAK 2024 Summit featured discussions on digital transformation in education, with TÜBİTAK's ULAKBİM highlighting the deployment of the Pardus national operating system across educational institutions (TÜBİTAK, 2024).

The World Bank's assessment of Turkey's digital education systems confirmed that post-COVID policy focus on strengthening EBA as an integrated LMS, enhancing IT infrastructure, creating educational content, and providing ongoing teacher support has been substantial (World Bank, 2023). The government's \$1.68 billion allocation for Imam Hatip schools in 2018 alone –

representing one-third of Turkey's total high school budget – reflects the scale of investment (Setiaji, 2024).

Imam Hatip schools specifically benefit from this digital ecosystem while maintaining their distinctive dual curriculum of general European-standard subjects and Islamic sciences (Setiaji, 2024; Sidik, 2024). The boarding system at international Imam Hatip schools, accommodating students from diverse countries, has embraced digital communication and management tools as integral to their multinational operational model.

Qualitative maturity classification: Established to Advanced (systemic national infrastructure; integrated platforms; AI-driven personalization emerging; strong government investment).

School Effectiveness Management by Country

Indonesia

SEM in Indonesian pesantren is fundamentally shaped by the Kyai's leadership model. Studies document the Kyai as simultaneously functioning as spiritual guide, instructional leader, and institutional manager (Bahri et al., 2024). Norman et al. (2025) found that strategic leadership incorporating transformational management and collaborative governance significantly enhances educational quality, though effectiveness varies across institutional contexts due to financial and structural limitations. Permana (2024) demonstrated that integrated quality management implementation at Nihayatul Amal pesantren improved students' academic performance and participation, with open communication and stakeholder involvement as key enablers. The integration of national curriculum (*Kurikulum Merdeka*) with pesantren's *diniyah* curriculum represents a central SEM challenge, with Yolanda et al. (2025) documenting successful integration through technology-mediated approaches at Modern Assalaam Islamic Boarding School.

Malaysia

Malaysian Islamic boarding schools operate within a more centralized governance framework, with government-aided SMKA schools following standardized management protocols aligned with the Malaysia Education Blueprint (Malaysia Education Blueprint, 2023). The emphasis on measurable outcomes, standardized assessment, and systematic teacher professional development creates a more uniform SEM landscape. However, research by Abdullah (2025) on Continuing Professional Development (CPD) models reveals divergent trajectories between Malaysia and Indonesia, with Malaysia demonstrating more institutionalized approaches. The Penang Institute's analysis highlighted the importance of strengthening teachers' digital competencies through targeted training programs and establishing community-based digital learning hubs as effectiveness-enhancing strategies (Penang Institute, 2025).

Pakistan

SEM implementation in Pakistani madrasahs remains constrained by the fundamental challenge of regulatory fragmentation. Sattar (2024) noted that key obstacles include "ideological resistance, inadequate funding, lack of trained teachers for modern subjects, and political interference." The Single National

Curriculum initiative aims to harmonize educational standards, but madrasah compliance remains inconsistent. Digital tools for management and monitoring—which are critical SEM enablers—are largely absent from the madrasah sector. Hassan et al. (2024) found that school leadership support and culturally sensitive technology integration approaches are crucial prerequisites for any effectiveness improvement.

Turkey

Turkey's Imam Hatip schools benefit from systematic SEM structures embedded within the national education system's quality assurance frameworks. The curriculum integrates general and vocational religious subjects with clear weekly schedules and performance expectations (Setiaji, 2024). The evolution of Imam Hatip schools from marginalized institutions under Kemalist secularism to flagship educational establishments under the AKP government has been accompanied by significant investment in infrastructure, curriculum modernization, and management professionalization (Bestari, 2026). Student exchange programs with Indonesian, Malaysian, and Thai Islamic schools further reflect an internationally oriented effectiveness model (Setiaji, 2024). The Türkiye Century Education Model explicitly connects technological integration with cultural identity strengthening and critical thinking development, creating a holistic SEM approach that balances digital innovation with value preservation (Yeni Şafak, 2026).

Comparative Analysis

Table. 1 Cross-National Digital Maturity Comparison

Dimension	Indonesia	Malaysia	Pakistan	Turkey
National Digital Policy	Merdeka Belajar; emerging pesantren-specific guidance	Malaysia Education Blueprint; Digital Education Policy 2023	Single National Curriculum; limited madrasah coverage	FATİH Project; Türkiye Century Education Model
Platform Infrastructure	Varied; E-Santren, institutional LMS	DELIMa; AINS; centralized platforms	TeleSchool; eTaleem Portal; limited madrasah reach	EBA; MEBİ (AI-driven); TRT EBA TV

Hardware/Connectivity	~40% stable internet in some regions; outdated hardware	Urban well-equipped; rural gaps persist	Severe urban-rural divide; patchy connectivity	Interactive whiteboards in all schools; nationwide broadband
Digital Literacy (Educators)	Low to moderate; Kyai-dependent adoption	Moderate; structured CPD programs	Low; critical training deficit	Moderate to high; systematic teacher training
Cultural Resistance	Significant in salafiyah pesantren	Moderate; post-pandemic acceptance growing	High in traditional madrasah networks	Low; government-mandated integration
Maturity Classification	Emerging-Developing	Developing-Established	Emerging	Established-Advanced

Common Patterns

Several cross-cutting patterns emerge from the comparative analysis:

1. **COVID-19 as universal accelerator.** All four countries experienced the pandemic as a forcing function for digital adoption. However, the sustainability of pandemic-era innovations varies significantly: Turkey and Malaysia have institutionalized their digital platforms, while many Indonesian and Pakistani institutions reverted to traditional modes post-pandemic (Mukarromah et al., 2025; ISIS Malaysia, 2023).
2. **Leadership as the critical mediating variable.** Whether it is the Indonesian Kyai, Malaysian school principal, Pakistani Mudir, or Turkish Hoca, the orientation and digital competency of institutional leaders consistently determines the pace and depth of both digital transformation and SEM implementation (Bahri et al., 2024; Norman et al., 2025; Hassan et al., 2024).
3. **Shared challenges of balancing tradition and modernity.** All four countries document tensions between preserving Islamic educational values and embracing digital tools. This is most acute in Pakistani madrasahs and Indonesian salafiyah pesantren, where technology is sometimes perceived as incompatible with traditional pedagogical methods (Sattar, 2024; Nurwahidin et al., 2023).
4. **Infrastructure as the foundational constraint.** Across all contexts, physical infrastructure – internet connectivity, hardware availability, electricity reliability – remains the primary determinant of digital maturity, particularly in rural settings (Tantowi, 2025; Penang Institute, 2025; Ghani et al., 2024).

Key Differences

1. **Government investment and policy coherence.** Turkey's centralized educational governance and substantial financial investment (e.g., \$1.68 billion for Imam Hatip schools in 2018) create systemic advantages absent in the more fragmented governance structures of Indonesia and Pakistan (Setiaji, 2024; World Bank, 2023). Malaysia occupies a middle position with strong policies but implementation challenges in peripheral regions (Penang Institute, 2025).
2. **Regulatory reach into Islamic boarding institutions.** Turkish Imam Hatip schools are fully integrated into the national education system and subject to all national digital education mandates. Malaysian SMKA are similarly government-regulated. In contrast, Indonesian pesantren and Pakistani madrasahs operate with varying degrees of autonomy, making policy implementation inconsistent (Bestari, 2026; Sattar, 2024).
3. **Role of religious leaders in digital governance.** The Kyai's centrality in Indonesian pesantren creates a unique model where digital transformation is essentially leader-dependent rather than system-dependent (Bahri et al., 2024; Hasan, 2023). This contrasts with the more institutionalized, bureaucratic governance in Turkish and Malaysian systems.
4. **Scope of digital transformation.** Turkey's initiatives encompass AI-driven personalized learning, VR/3D innovation labs, and homegrown educational technology development through ETKİM (Yeni Şafak, 2026). Indonesian pesantren are primarily at the stage of basic LMS adoption and digital administration (Wajdi et al., 2024). Pakistani madrasahs remain largely pre-digital in their operational modalities (Sattar, 2024).

Implications

Theoretical Implications

This review contributes a preliminary cross-national framework for understanding digital maturity in Islamic boarding contexts, extending generic digital maturity models (Bravo-Jaico et al., 2025; Digital Maturity Models, 2025) by incorporating the religio-cultural governance dimension unique to these institutions. The finding that Kyai/leader orientation serves as the primary mediating variable between institutional digital capacity and SEM effectiveness suggests the need for leadership-centered digital maturity models tailored to faith-based educational organizations.

The study also extends SEM theory by demonstrating that school effectiveness in Islamic boarding institutions cannot be reduced to conventional indicators (academic outcomes, management efficiency) but must encompass spiritual formation, character development, and communal living management—dimensions amplified or challenged by digitalization (Permana, 2024; El-Yunusi, 2025).

Practical Implications

For **Indonesian** pesantren, the experiences of Turkey and Malaysia offer actionable models. The development of a national pesantren digital platform—analogue to Turkey's EBA or Malaysia's DELIMa—could address the current

fragmented, institution-dependent approach. Investment in Kyai digital leadership training is critical, as the literature consistently identifies leader orientation as the primary transformation enabler (Bahri et al., 2024).

For **Malaysia**, the key priority is closing the rural-urban implementation gap and ensuring that Islamic boarding schools in East Malaysia and rural peninsular regions receive equitable access to the platforms and training already available in urban centers (Penang Institute, 2025).

For **Pakistan**, the fundamental prerequisite is extending government digital education infrastructure into the madrasah sector through regulatory harmonization and incentivized participation, recognizing that ideological resistance requires culturally sensitive engagement strategies rather than top-down mandates (Sattar, 2024; Hassan et al., 2024).

For **Turkey**, the opportunity lies in leveraging its advanced digital infrastructure to develop exportable models for Islamic educational technology, potentially through South-South cooperation with Indonesian, Malaysian, and Pakistani institutions—building on the student exchange programs that already connect Turkish Imam Hatip schools with Southeast Asian Islamic institutions (Setiaji, 2024).

Across all four countries, the critical weak areas identified in the literature—data-driven decision-making, learning analytics, AI integration, and systematic digital maturity assessment—represent priority domains for both policy development and future research (Calista, 2025; Bravo-Jaico et al., 2025).

CONCLUSIONS AND RECOMMENDATIONS

This comparative literature review reveals that the relationship between digital maturity and School Effectiveness Management in Islamic boarding institutions is deeply mediated by national policy frameworks, infrastructure investment, regulatory reach, and religio-cultural leadership structures. Turkey leads the four-country comparison with systemic, government-driven digital integration across Imam Hatip schools. Malaysia demonstrates structured policy progress with persistent implementation gaps. Indonesia exhibits the widest variance, with modern pesantren approaching meaningful digital integration while traditional institutions remain at nascent stages. Pakistan faces the most significant challenges, with its madrasah system largely disconnected from national digital education initiatives.

As a literature-based study, the findings require validation through direct empirical investigation. Three priority areas for future research emerge: (1) development and cross-national validation of a digital maturity index instrument specifically designed for Islamic boarding institutions, incorporating religio-cultural governance dimensions; (2) multi-country field studies employing mixed-methods designs to directly assess the causal relationship between digital maturity and SEM outcomes; and (3) longitudinal studies tracking the sustainability of post-pandemic digital adoption in Islamic boarding institutions across all four countries. Such research would transform the preliminary framework proposed here into an evidence-based tool for policy formulation and institutional

development, ultimately contributing to the quality and relevance of Islamic boarding education in the digital age.

FURTHER STUDY

Further research could explore digital maturity and school effectiveness management through empirical comparative studies involving Islamic boarding institutions across Indonesia, Malaysia, Pakistan, and Turkey. Future studies may examine how digital leadership, infrastructure, teacher digital competence, and institutional readiness influence management effectiveness and educational outcomes. Longitudinal research is also recommended to assess changes in digital maturity and identify sustainable strategies for digital transformation in Islamic boarding education.

ACKNOWLEDGMENT

The authors would like to express their gratitude to all individuals and institutions whose support and contributions assisted in the completion of this literature review.

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