

# A Contextual Artificial Intelligence Ecosystem Framework for STIT Bustanul Ulum: A Multisite Comparative Study of the Zawia University and Badakhshan University

Dedi Andrianto<sup>1\*</sup>, Syaifur Rohman<sup>2</sup>, Siska Difita Sari<sup>3</sup>

<sup>1</sup>STIT Bustanul 'Ulum Lampung Tengah, Indonesia

<sup>2</sup>STIT Al Mubarak Bandar Mataram, Lampung Tengah, Indonesia

[dediandrianto101@gmail.com](mailto:dediandrianto101@gmail.com)\*

## Abstract

The rapid diffusion of artificial intelligence (AI) in higher education presents significant governance challenges, particularly in institutions operating within distinct ethical and cultural contexts. However, existing AI governance models remain largely technocratic and insufficiently responsive to local institutional realities. This study aims to develop a contextually grounded and policy-relevant Artificial Intelligence Ecosystem Framework tailored to Islamic higher education institutions. Employing a qualitative multisite comparative design, the research was conducted at STIT Bustanul Ulum (Indonesia), the Zawia University (Libya), and Badakhshan University (Afghanistan). Data were collected through semi-structured interviews, institutional observations, and document analysis, and were analyzed using cross-case thematic comparison. The findings reveal that effective AI adoption is not determined solely by technological capacity but by coordinated institutional readiness across five interdependent dimensions: digital infrastructure, human resource competence, adaptive institutional policy, ethical orientation, and collaborative sustainability networks. The study further demonstrates that within Islamic higher education, ethical and religious values function as internal regulatory mechanisms that promote responsible AI governance rather than inhibit innovation. The proposed AI Ecosystem Framework offers a holistic governance model that integrates technological advancement with contextual, ethical, and institutional considerations, contributing both theoretically to AI governance discourse and practically to policy development in faith-based higher education settings.

**Keywords:** AI policy, Islamic higher education, AI governance, ethical AI

## INTRODUCTION

Digital transformation in higher education has positioned Artificial Intelligence (AI) as a strategic element in enhancing the quality of learning, research, and institutional governance. A growing body of literature indicates that AI adoption enables adaptive learning environments, improves academic efficiency, and stimulates innovation as well as research productivity (Bhutoria, 2022; Salsabilla et al., 2023; Lushyn & Sukhenko, 2024). At the global level, the development of AI ecosystems in universities has increasingly been oriented toward the creation of responsive and future-ready institutions capable of addressing the evolving demands of learners in the digital era.

Nevertheless, existing studies on AI ecosystems in higher education remain largely dominated by technocratic approaches and perspectives derived from well-resourced universities. AI is frequently positioned

as a universal solution that can be uniformly adopted across institutions, with limited consideration of social, cultural, and value-based contexts. Several studies caution that non-contextualized AI adoption may generate ethical challenges, erode educational values, and exacerbate inequalities in access to technology (Triansyah et al., 2023; Alam & Mohanty, 2022). In value-based and religious higher education institutions, these risks carry deeper implications. Educational processes in such institutions are not merely oriented toward knowledge transfer and efficiency but are intrinsically connected to moral formation, spiritual development, and the preservation of institutional ethos. Uncritical AI integration may disrupt pedagogical traditions grounded in ethical mentorship, reduce human-centered learning interactions, and introduce epistemological tensions between algorithmic rationality and faith-informed knowledge systems. Moreover, without context-sensitive governance, AI tools may inadvertently conflict with religious norms concerning authorship, accountability, and moral responsibility. Therefore, AI adoption in religious higher education requires governance frameworks that align technological innovation with ethical principles, institutional identity, and value-based educational missions rather than treating technology as a neutral and universally applicable instrument.

These challenges are particularly pronounced in the context of Private Islamic Higher Education Institutions (Perguruan Tinggi Keagamaan Islam Swasta/PTKIS), especially those located in regional or peripheral areas. In addition to constraints related to digital infrastructure, funding, and human resource capacity, PTKIS carry a normative mandate to ensure that digital transformation aligns with Islamic values. Despite this distinctive institutional character, empirical studies that explicitly formulate AI ecosystems grounded in Islamic values remain scarce. The UNESCO report (2024) further highlights a significant research gap concerning AI adaptation strategies that are sensitive to the characteristics of religious higher education institutions in developing countries.

Several universities in developing contexts have demonstrated context-sensitive AI adaptation practices. The Zawia University in Libya. For instance, has implemented AI-based learning systems and adaptive learning management platforms despite infrastructural limitations (Baroud et al., 2024). Similarly, Badakhshan University in Afghanistan has integrated AI into its curriculum by incorporating socio-cultural and religious considerations through multi-stakeholder collaboration (Qasimi et al., 2023). The selection of Zawia University and Badakhshan University as comparative case studies follows the logic of most similar system design (MSSD). Both institutions operate within Muslim-majority societies where higher education is closely intertwined with religious norms, cultural traditions, and value-based educational missions. Structurally, they share comparable constraints limited digital infrastructure, financial restrictions, and governance challenges typical of developing contexts conditions that parallel those experienced by many Indonesian PTKIS (Private Islamic Higher Education Institutions). This similarity allows the study to isolate institutional governance patterns rather than macroeconomic variables as primary explanatory factors. At the same time, the two universities exhibit variations in their AI integration strategies, enabling analytical replication across cases. By comparing convergent and divergent governance practices, the study aims to identify transferable institutional mechanisms rather than context-bound technical solutions. Despite these documented practices, no prior research has systematically synthesized such experiences into a structured and replicable AI governance framework tailored to PTKIS in Indonesia. This methodological gap justifies the comparative design and underscores the need to construct a contextual Artificial Intelligence Ecosystem Framework grounded in empirically comparable institutional realities.

STIT Bustanul Ulum Lampung Tengah, as a regional PTKIS, faces comparable challenges related to digital readiness, human resource capacity, and the integration of Islamic values in technology adoption. Prior studies have largely focused on mapping opportunities and challenges associated with AI implementation, without offering a contextual and actionable conceptual model tailored to the needs of regional PTKIS. Consequently, a significant research gap persists regarding the absence of an AI ecosystem framework specifically designed to integrate technological, institutional, and Islamic value dimensions in a coherent manner.

This study offers a novel contribution by developing a contextual Artificial Intelligence ecosystem framework that is explicitly integrated with Islamic values and tailored to regional Islamic higher education institutions through a multisite comparative study across developing countries. Unlike previous studies that tend to adopt global AI frameworks in a technocratic manner, this research positions Islamic values, institutional readiness, and resource constraints as core components in the design of the AI ecosystem. In line with this novelty, the study aims to analyze the readiness and challenges of STIT Bustanul Ulum Lampung Tengah in developing an AI ecosystem, synthesize key lessons from the Zawia University and Badakhshan University, and formulate an adaptive, applicable, and sustainable AI ecosystem framework for regional PTKIS.

In other side, this study makes both theoretical and practical contributions. Theoretically, it enriches the literature on AI ecosystems in higher education by introducing a contextual framework that integrates technological, institutional, and Islamic value dimensions an area that remains underexplored in existing research. Practically, the study provides an applicable and replicable AI ecosystem model for regional PTKIS facing resource constraints. Moreover, the findings offer strategic insights for policymakers in Islamic higher education to design digital transformation initiatives that are sustainable, ethically grounded, and aligned with the distinctive character of religious institutions.

## **METHODS**

This study employs a qualitative approach with a multisite comparative case study design to examine and develop an Artificial Intelligence (AI) ecosystem framework at STIT Bustanul Ulum (Indonesia), the Zawia University (Libya), and Badakhshan University (Afghanistan). A qualitative design is appropriate for capturing complex institutional phenomena within their specific contexts through in-depth engagement and rich data sources (Creswell & Creswell, 2018). The multisite approach enables cross-institutional comparison of AI implementation strategies, challenges, and enabling factors, while identifying transferable patterns relevant to Islamic higher education institutions. Previous studies confirm the effectiveness of multisite designs in generating contextualized and comparative insights (Baroud et al., 2024).

Data were collected through in-depth interviews, direct observation, and document analysis to ensure triangulation and analytical rigor. Interviews were conducted with academic staff and administrators to explore roles, challenges, and capacity needs in AI adoption; institutional policymakers to examine strategic orientations and governance frameworks; and students to capture learning experiences and perceptions of AI use (Fathor, 2015). Observations focused on actual AI utilization in learning, administration, and research, as well as the condition of digital infrastructure and user-technology interactions (Lukman et al., 2024). Document analysis of institutional policies, strategic plans, annual reports, and internal publications provided

contextual and historical perspectives on AI ecosystem development and supported data triangulation ([Hamsar et al., 2024](#)).

## RESULTS AND DISCUSSION

### Results

The comparative analysis across the three institutional contexts reveals that the development of an artificial intelligence ecosystem in Islamic higher education is neither linear nor solely determined by technological availability. Instead, AI adoption emerges as a complex institutional transformation shaped by the interplay between infrastructure readiness, human resource capacity, governance structures, ethical orientations, and collaborative networks. The findings indicate that disparities in digital infrastructure significantly influence the pace of AI integration. However, infrastructure alone does not guarantee meaningful adoption. Institutions with relatively limited technological resources may still demonstrate adaptive potential when supported by strong leadership commitment, collaborative learning cultures, and value-based orientations. This underscores that AI integration is fundamentally a socio-institutional process rather than a purely technical endeavor.

Across sites, human resources appear as a critical mediating factor between technological possibility and institutional practice. While lecturers, students, and administrative staff generally exhibit positive attitudes toward AI, their limited technical competencies constrain actual implementation. This gap highlights that readiness for AI adoption is not merely a matter of awareness or acceptance, but of sustained capacity-building and institutional learning. Importantly, the findings suggest that professional development and curriculum adaptation play a strategic role in translating AI from an abstract innovation into a pedagogically meaningful tool. Without deliberate investment in human capital, AI risks remaining peripheral or symbolic rather than transformative.

Institutional policy and managerial support further differentiate the trajectories of AI ecosystem development. Where clear strategic direction, regulatory frameworks, and resource allocation are present, AI initiatives tend to be more coherent and sustainable. Conversely, the absence of formal policies results in fragmented and ad-hoc practices driven by individual initiative rather than institutional vision. This confirms that governance functions as a structuring mechanism that stabilizes innovation and aligns technological change with institutional goals. In the context of Islamic higher education, policy frameworks also serve as a bridge between innovation and normative accountability.

A distinctive insight of this study lies in the central role of Islamic ethical values in shaping AI adoption. Rather than acting as barriers, ethical and religious considerations operate as internal regulatory logics that guide responsible use, academic integrity, and social accountability. The integration of AI is thus negotiated through moral reasoning, cultural sensitivity, and collective deliberation, reinforcing the notion that technology is socially constructed within specific epistemological traditions. This ethical embeddedness influences both acceptance and resistance, highlighting the importance of value compatibility in the diffusion of innovation within faith-based institutions.

Collaboration emerges as a decisive factor for sustainability, particularly for institutions operating under resource constraints. Cross-institutional partnerships, government alignment, and engagement with

international networks enable access to expertise, infrastructure, and strategic learning that would otherwise be unattainable. The comparative evidence suggests that collaboration accelerates innovation diffusion while mitigating institutional vulnerability, positioning networks not merely as support mechanisms but as integral components of the AI ecosystem itself.

Synthesizing these reflections, this study advances a theory-informed Artificial Intelligence Ecosystem Framework tailored to Islamic higher education institutions. Moving beyond technocentric and readiness-oriented models, the framework conceptualizes AI adoption as an ecosystemic process constituted by five interdependent dimensions: digital infrastructure as enabling conditions, human resource capacity as agentic capability, institutional policy as governance architecture, Islamic ethical values as normative orientation, and collaboration as a mechanism of systemic sustainability. By theorizing ethics as an internal organizing principle rather than an external constraint, the framework reconceptualizes responsible AI adoption as a culturally embedded institutional transformation. Consequently, this study extends existing AI-in-education theories by offering a context-sensitive, value-oriented, and ecosystem-based analytical lens, particularly relevant for resource-constrained yet normatively grounded higher education contexts.

Drawing on a multisite comparative analysis of STIT Bustanul ‘Ulum (Indonesia), the Zawia University (Libya), and Badakhshan University (Afghanistan), this study demonstrates that AI implementation in Islamic higher education requires policy approaches distinct from those commonly adopted in Western contexts. AI integration in these institutions is strongly shaped by ethical values, humanitarian principles, and religious norms, which must be systematically embedded within institutional strategies. The findings suggest that effective AI governance depends on coordinated readiness across digital infrastructure, human resource capacity, regulatory frameworks, and institutional digital culture. Without such alignment, AI initiatives risk remaining fragmented and unsustainable. In response, this study formulates an AI Ecosystem Framework designed to inform policy formulation and strategic decision-making in Islamic higher education institutions, as outlined in the following table and diagram.

Table 1. Core Structure of the AI Ecosystem Framework

No	Main Dimension / Pillar	Implementation Focus	Inter-Component Interaction Mechanism
1	Digital Infrastructure Readiness	Readiness of network systems and digital learning platforms	Provision, upgrading, and maintenance of Wi-Fi networks, servers, and Learning Management Systems (LMS)
2	Human Resources & Digital Competence	Capacity building of lecturers and students	Education programs, training, workshops, seminars, and focus group discussions (FGDs)
3	AI Policy & Governance	Development of institutional digital and AI policies	AI governance frameworks ensuring transparency, accountability, and data security
4	Ethics & Islamic Worldview Integration	Integration of Islamic values in AI implementation	Maqāṣid al-Sharīḥ as ethical and normative guidelines

5	Collaboration & Sustainability	Research networking and sustainable AI development	AI Literacy Hubs, inter-institutional collaboration, and global research partnerships
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Table 2. Implementation Roadmap of the AI Ecosystem Framework

Phase	Implementation Focus	Key Activities	Success Indicators
Phase 1 – Digital Foundation (2025–2026)	Establishing digital readiness	Strengthening digital infrastructure, forming an AI task force, and deploying a Learning Management System (LMS)	At least 80% of the academic community actively engaged in online learning systems
Phase 2 – Human Resource Capacity Building (2026–2027)	Enhancing AI-related competencies	AI training programs, research initiation, and curriculum integration	Lecturers and students demonstrate basic AI literacy and applied competence
Phase 3 – Institutional Implementation (2027–2028)	Formalizing AI governance	Development and enforcement of AI ethics policies, governance structures, and institutional collaborations	AI policies and governance frameworks formally adopted and implemented
Phase 4 – Sustainability and Institutional Leadership (2028–2030)	Ensuring long-term impact	Establishment of an Islamic-based AI Research Center and expansion of national and international partnerships	STIT Bustanul Ulum recognized as a reference institution for Islamic AI ecosystem development

Overall, this theoretical discussion underscores that the successful development of AI ecosystems in Islamic higher education requires a holistic and theory-informed approach. Innovation diffusion theory (Rogers) highlights the importance of individual acceptance and value compatibility, while the RAISE framework (Bhutoria, 2022) provides a structured institutional pathway for AI adoption. Contextual technology integration theories further emphasize that technological innovation must be aligned with local socio-cultural and religious environments to ensure legitimacy and sustainability. Empirically, the findings reinforce UNESCO’s (2024) identification of global disparities in AI readiness, particularly in terms of infrastructure and human resource capacity, and align with Triansyah et al. (2023) regarding the necessity of embedding ethical governance from the earliest stages of AI adoption. The case of the Zawia University further supports Baroud et al. (2024), demonstrating that high levels of AI awareness among lecturers require continuous and advanced training to translate into effective practice. Synthesizing these theoretical and empirical insights, the following Framework Figure and Table conceptualize an integrated AI Ecosystem Model for Islamic higher education, illustrating the interdependent dimensions and implementation pathways identified in this study.

## Discussion

The rapid Artificial Intelligence (AI) has emerged as a central driver of digital transformation in higher education, reshaping teaching, learning, research, and institutional governance. A growing body of literature demonstrates that AI supports personalized learning, enhances administrative efficiency, and enables data-driven decision-making at the institutional level. The rapid diffusion of AI, particularly through generative technologies such as ChatGPT, has accelerated these transformations while simultaneously introducing new pedagogical, ethical, and governance challenges that require systematic theoretical examination (Subiyantoro et al., 2023; Zahra Salsabilla et al., 2023; Lushyn & Sukhenko, 2024). Consequently, AI adoption in higher education can no longer be understood as a standalone technological innovation, but rather as a complex institutional process embedded within broader socio-technical systems.

In response to this complexity, the concept of an AI ecosystem has been widely adopted as a comprehensive analytical lens. An AI ecosystem in higher education is understood as an integrated system that connects digital infrastructure, human resource capacity, governance frameworks, curriculum integration, and institutional policies to enable effective and sustainable AI utilization. Previous studies identify these five components as foundational elements for successful AI integration (Serpil & Kesim, 2024). Beyond pedagogical applications, AI has increasingly been employed in administrative domains such as admissions management, academic services, and decision-support systems, with chatbots and recommendation engines becoming standard institutional tools (Ramadhan, 2023; Rifky, 2024). However, the emergence of generative AI has further intensified the strategic importance of AI ecosystems by expanding opportunities for automated assessment, content generation, and personalized academic support (Hu et al., 2024; Galés, 2024). At the same time, scholars caution that unregulated or uncritical adoption of generative AI may exacerbate issues related to academic integrity, over-automation, and the erosion of pedagogical values, thereby underscoring the need for robust governance and ethical frameworks (Rinanda & Pengeran, 2021).

These concerns have led to an increased emphasis on the ethical dimensions of AI integration in higher education. Numerous studies highlight critical risks related to data privacy, algorithmic bias, transparency, and equitable access to AI technologies (Jupalli et al., 2022; Triansyah et al., 2023). Systematic reviews grounded in principles of fairness, accountability, transparency, and ethics (FATE) stress that ethical considerations must be embedded within institutional AI governance rather than treated as peripheral issues (Chaudhry & Kazim, 2022). Alongside these ethical concerns, the literature consistently emphasizes the importance of AI literacy as a core competency for future graduates. AI literacy enables students to critically interpret intelligent systems, apply them responsibly, and adapt to professional environments increasingly shaped by AI (Bhardwaj & Sharma, 2024). Accordingly, effective AI ecosystem development requires not only technological investment but also sustained professional development for educators, curriculum re-design, and institutional support mechanisms that preserve the human dimension of education.

Understanding how AI ecosystems emerge and evolve within higher education institutions necessitates a theoretical perspective on technological adoption. Diffusion of Innovation Theory provides a foundational framework for analyzing how AI technologies spread across institutional contexts. Rogers conceptualizes diffusion as a communication process involving innovation characteristics, communication channels, social systems, and time. Within Islamic higher education the adoption of artificial intelligence is

not limited to technological modernization. It involves institutional adjustments that affect curriculum design, teaching practices, governance procedures, and ethical accountability (Alexandra & Budiyanara, 2022). In Islamic higher education settings, where educational goals are closely linked to moral formation and religious values, the integration of AI requires careful alignment with institutional identity and normative commitments. Rather than being treated as a purely technical upgrade, AI implementation must be evaluated in relation to pedagogical authority, academic integrity, and the preservation of value-based educational traditions. Empirical studies identify five stages of adoption: awareness, interest, evaluation, trial, and full adoption, each of which requires careful assessment of value compatibility, perceived complexity, and institutional readiness (Taib, 2024). Innovation attributes such as relative advantage, compatibility, complexity, trialability, and observability play a decisive role in shaping adoption trajectories. Importantly, in value-based educational institutions, these attributes must be interpreted through ethical and philosophical lenses, indicating that AI diffusion is not merely a technical process but an epistemological transformation that reshapes how knowledge is produced, validated, and disseminated.

While Diffusion of Innovation Theory explains the dynamics of adoption, it does not fully account for the contextual diversity of higher education institutions. Addressing this limitation, Contextual Technology Integration Theory emphasizes that technological implementation is inherently situational and shaped by local conditions. This theory highlights four interrelated dimensions: organizational culture, social infrastructure, economic capacity, and religious-cultural values (Subchan, 2024; Ummah, 2019). From this perspective, technology is not a neutral instrument but a socially embedded practice that both shapes and is shaped by its institutional context. Consequently, effective AI integration requires context mapping prior to implementation, adaptive system design, participatory stakeholder engagement, and continuous capacity development (Haerani et al., 2024). This approach is particularly relevant for higher education institutions in developing regions, where resource constraints and strong value orientations necessitate flexible and context-sensitive strategies.

Efforts to translate conceptual discussions on AI governance into institutional practice have led to the development of several structured implementation models. One example is the RAISE framework, which groups AI integration into five interconnected domains: readiness, adoption, implementation, sustainability, and evaluation (Bhutoria, 2022). Rather than presenting these components as a rigid sequence, the framework underscores the importance of institutional preparedness, leadership alignment, resource continuity, and ongoing assessment in shaping the long-term viability of AI initiatives within higher education settings. Empirical evidence from diverse institutional settings indicates that RAISE effectively guides holistic institutional transformation by emphasizing diagnostic assessment, phased implementation, long-term sustainability, and multidimensional evaluation (Serpil & Kesim, 2024; Filho et al., 2024). The readiness phase assesses institutional capacity across infrastructure, human resources, organizational culture, leadership, ethics, and economic sustainability, while subsequent phases focus on strategic adoption, continuous capacity development, and participatory evaluation mechanisms that account for technological, pedagogical, ethical, and social impacts. As such, the RAISE framework provides a robust conceptual foundation for developing a

contextual AI ecosystem model that aligns technological innovation with institutional values and long-term sustainability.

## CONCLUSION

This study concludes that the development of an artificial intelligence (AI) ecosystem in Islamic higher education is a complex institutional process that extends beyond technological readiness. The findings demonstrate that sustainable AI adoption is shaped by the dynamic interaction of digital infrastructure, human resource capacity, institutional governance, ethical orientation, and collaborative networks. Importantly, Islamic ethical values emerge not as barriers but as internal organizing principles that legitimize and guide responsible AI integration. Building on these insights, the study advances an ecosystem-based framework that embeds ethics and culture at the core of AI adoption, thereby extending prevailing AI-in-education and innovation diffusion theories. This framework offers a strategic and context-sensitive reference for Islamic higher education institutions, particularly in resource-constrained settings, to pursue ethical, adaptive, and sustainable digital transformation.

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