

Intelligent Machines and Organizational Knowledge Transformation in Bangladesh's Islamic Banking Sector: Navigating Innovation and Shariah Compliance

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Abstract: This study explores how innovative organizational culture and Shariah compliance frameworks influence the effectiveness of AI-integrated knowledge systems in Bangladesh's Islamic banking sector. Drawing on semi-structured interviews with six stakeholders including innovation leaders, Shariah officers, and AI managers, the research applies thematic analysis using a hybrid coding approach in NVivo and develops a moderated-mediation model. Findings indicate that banks with a culture of experimentation, collaboration across functions, and incentive structures are more successful in embedding AI into Shariah knowledge processes. Strong governance frameworks that emphasize transparency, agile policy updates, and theological oversight ensure that AI-generated rulings remain doctrinally sound and operationally valid. Knowledge sharing practices such as AI-augmented portals, peer learning sessions, and workshops mediate the effectiveness of culture and governance by facilitating the dissemination and validation of Shariah insights. Workforce digital literacy moderates these relationships, as institutions with digital champions and structured training programs achieve faster adoption and greater staff confidence in AI outputs. The study advances digital transformation theory, Islamic corporate governance, and knowledge management by showing how culture, governance, and human capacity collectively enable ethical AI adoption. It offers practical guidance for banks and regulators on aligning innovation with Shariah integrity to build agile and trustworthy knowledge systems.

Keywords: Islamic banking, Shariah compliance, Artificial intelligence (AI), Knowledge management, Digital transformation.

1. INTRODUCTION

As Bangladesh's Islamic banking sector embraces digital transformation, the integration of intelligent machines with Shariah governance introduces both opportunities and institutional complexities. AI-powered compliance tools, knowledge automation systems, and digital Shariah audit platforms are reshaping how Islamic banks interpret, disseminate, and apply religious rulings in real-time operational contexts (Thaib *et al.*, 2025; Leuwol *et al.*, 2024; Harunoğulları, 2025; Arsyad *et al.*, 2025; Al Hammadi, 2025). Yet, this technological shift often outpaces the evolution of governance structures, staff competencies, and knowledge-sharing mechanisms required to maintain ethical and doctrinal consistency. While innovation offers scalability, it risks undermining Shariah integrity if not aligned with robust compliance frameworks and a culture of organizational learning (Susiang *et al.*, 2024; Rahman, 2025; Polas *et al.*, 2025).

Despite promising initiatives such as AI-summarized fatwas, automated rule validation engines, and smart intranet portals, Islamic banks in Bangladesh continue to face constraints including fragmented digital literacy, resistance among scholars, audit opacity, and lack of harmonized codification protocols for AI-encoded rulings (Leuwol *et al.*, 2024;

Arşyad *et al.*, 2025; Uddin & Mohiuddin, 2020). These barriers reduce compliance efficiency and restrict adaptation to evolving financial technologies in a doctrinally sound manner (Hassan *et al.*, 2022a). Consequently, innovation often remains limited to isolated pilot projects (Jannat, 2025) with weak cross-functional integration and institutional buy-in (Rahman, 2025; Thaib *et al.*, 2025).

While scholarship on Islamic fintech, AI governance, and Shariah audit systems is expanding, empirical research linking organizational culture, governance frameworks, knowledge sharing, and digital proficiency to knowledge effectiveness in Islamic banks is still nascent. Few studies explore how digital literacy and knowledge practices interact (Olabode, 2024) with innovation culture and Shariah governance to shape AI-integrated compliance ecosystems (Yıldırım *et al.*, 2020; Polas *et al.*, 2025; Harunoğulları, 2025). Furthermore, limited attention has been given to how innovative cultures and governance frameworks can balance doctrinal authenticity with the agility demanded by intelligent systems (Arşyad *et al.*, 2025; Rahman, 2025).

This study addresses these gaps by examining how innovative organizational culture and Shariah compliance frameworks jointly influence the effectiveness of AI-enabled Shariah knowledge systems in Bangladesh. It introduces a moderated-mediation model where knowledge sharing practices mediate these relationships and workforce

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digital literacy moderates their impact. Grounded in digital transformation theory, Islamic governance frameworks, and knowledge management principles, the study contributes both theoretical and practical insights for banks, Shariah boards, regulators, and fintech innovators aiming to develop agile, transparent, and doctrinally sound knowledge systems in the age of intelligent machines.

1.1. Research Objectives

This study aims to examine how innovative organizational culture and Shariah compliance frameworks, mediated by knowledge sharing practices and moderated by workforce digital literacy, influence the effectiveness of AI-integrated Shariah knowledge transformation in Bangladesh's Islamic banking sector.

Specific objectives include:

- To analyze how innovative culture and Shariah compliance frameworks contribute to organizational Shariah knowledge effectiveness by enhancing consistency, update speed, and staff confidence in AI-guided decision-making.
- To assess the mediating role of knowledge sharing practices and the moderating effect of digital literacy in shaping the relationship between cultural-governance drivers and Shariah knowledge transformation outcomes.

2. LITERATURE REVIEW

2.1. Theoretical Underpinnings

This study draws on digital transformation theory (Vial, 2019), the resource-based view and its extension, the knowledge-based view (Barney, 1991; Grant, 1996), and Islamic corporate governance theory (Haniffa & Hudaib, 2007) to explore how intelligent systems reshape Shariah knowledge management in Bangladesh's Islamic banking sector. Digital transformation theory emphasizes the integration of technology, culture, and organizational processes to create sustained value in dynamic environments. It provides a lens to understand how AI tools—such as automated Shariah audits and machine learning-based fatwa classification—can enhance compliance efficiency when supported by innovation-friendly cultures and agile governance structures.

The resource-based view highlights how tangible and intangible assets like digital infrastructure and innovation culture drive competitive advantage, while the knowledge-based view focuses specifically on knowledge as a strategic resource. In this study, knowledge sharing practices act as a mediating mechanism, facilitating the translation of AI capabilities

into effective Shariah decision-making. Islamic corporate governance theory anchors the ethical and doctrinal dimensions, emphasizing the role of Shariah boards, audit mechanisms, and ethical oversight. Digital literacy is considered a moderating factor that shapes how these elements interact to influence Shariah knowledge effectiveness. Together, these theories support a moderated-mediation model that integrates cultural, technological, and ethical drivers of AI-enabled knowledge transformation.

2.2. Digital and Organizational Challenges in Shariah Knowledge Transformation

The digital and organizational challenges confronting Bangladesh's Islamic banking sector emerge from a rapid introduction of AI-powered compliance tools amid institutional inertia and fragmented governance. While banks have initiated AI fatwa summarization, automated Shariah audits, and intranet knowledge portals (Mia et al., 2016; Hassan et al., 2022b), many face compatibility issues with legacy systems, uneven digital workflows, and limited cross-departmental integration (Leuwol et al., 2024; Thaib et al., 2025; Yamin et al., 2025; Rahman, 2025). Governance gaps—such as inconsistent oversight of AI-generated rulings and the absence of standardized rule-encoding protocols (Karim et al., 2022)—compound the challenge of harmonizing ethical and technical systems (Arsyad et al., 2025; Susiang et al., 2024). Compared to Islamic financial hubs in Malaysia and the Gulf, Bangladesh's institutions lag in developing scalable Shariah AI ecosystems with embedded transparency, agility, and staff trust (Shaikh et al., 2024; Hidayat et al., 2024; Rabbani et al., 2022; Srairi, 2025).

Countries like Malaysia and Bahrain have adopted integrated Shariah governance models, regulatory sandboxes, and national fintech frameworks to streamline AI adoption in Islamic finance (Iqbal & Kassim, 2024; Shaikh et al., 2024; Kismawadi, 2025). In contrast, Bangladesh's initiatives remain pilot-driven and fragmented (Oyesanya & Fa-Yusuf, 2025), with limited policy support and uneven resource allocation (Rahman, 2025; Alzeaideen et al., 2024). This institutional disjoint limit scalability and hinders knowledge standardization across branches and banks. The situation underscores the need for cohesive digital governance, interdepartmental collaboration, and regulatory clarity (Mahama & Yakubu, 2025) to unlock the full potential of intelligent machines in Shariah knowledge transformation.

2.3. Shariah Compliance Framework

The Shariah compliance framework refers to the maturity and adaptability of the governance structures

guiding AI-driven decision-making in Islamic banking. Robust frameworks entail multi-tiered review boards, transparent audit trails, and agile fatwa propagation mechanisms, ensuring that AI outputs remain doctrinally sound and operationally valid (Hasna & Salleh, 2018; Arsyad *et al.*, 2025; Thaib *et al.*, 2025). Mature frameworks integrate real-time compliance dashboards, machine-readable fatwa registers, and metadata-tagged rulings to support traceability and organizational trust (Rahimi *et al.*, 2023; Leuwol *et al.*, 2024).

In Bangladesh, however, many banks rely on static, manually-updated fatwa repositories and lack systematized review protocols for AI-encoded rulings (Rahman, 2025; Al-Afeef *et al.*, 2024). Shariah boards often operate independently of innovation teams, resulting in slow approval processes and audit bottlenecks (Hasnat & Alom, 2017; Shehadeh, 2025). While prior studies emphasize the importance of governance in Islamic finance, they often neglect how compliance frameworks enable or constrain the institutionalization of AI tools—an oversight this study addresses.

2.4. Innovative Culture

Innovative culture is a core organizational condition that influences whether AI-enabled Shariah systems are adopted meaningfully. Cultures that encourage experimentation, cross-functional learning, and performance-based innovation rewards are more likely to succeed in embedding AI into core compliance practices (Hasnat & Talukder, 2017; Harunoğullari, 2025; Susiang *et al.*, 2024). In high-performing Islamic banks globally, innovation is driven through co-design between scholars and developers, knowledge-sharing forums, and internal competitions to refine AI outputs (Rahman, 2025; Leuwol *et al.*, 2024).

In Bangladesh, however, innovation often remains siloed within IT departments or reliant on a few champions, rather than being embedded institutionally (Thaib *et al.*, 2025; Rahman, 2025). Resistance among scholars, fear of doctrinal dilution, and lack of recognition for AI-based initiatives limit adoption (Ali & Abdullah, 2020). While past literature notes these cultural barriers, few studies systematically investigate how innovation culture mediates the relationship between governance, digital tools, and knowledge transformation—an inquiry central to this research.

2.5. Knowledge Sharing Practices

Knowledge sharing practices serve as the conduit through which AI insights and Shariah rulings are disseminated (Qudah *et al.*, 2023), interpreted, and

applied. These include AI-augmented portals, community learning spaces, peer review systems, and targeted workshops (Rahman *et al.*, 2025; Thaib *et al.*, 2025). In contexts where both formal (intranet tools) and informal (communities of practice) channels are active, knowledge moves more quickly and reliably from central Shariah boards to front-line staff, enhancing consistency and compliance (Susiang *et al.*, 2024; Alzeaideen *et al.*, 2024; Hasnat *et al.*, 2025a).

Bangladeshi Islamic banks, however, often face uneven engagement with such platforms. Staff continue to rely on outdated PDFs, unsynchronized documents, and manual consultations, which limit the effectiveness of AI-driven tools (Rahman, 2025). Prior research emphasizes the role of KM systems in general but lacks specific focus on how knowledge sharing mediates AI-Shariah ecosystem effectiveness—this study addresses that empirical gap.

2.6. Digital Literacy of Workforce

Digital literacy moderates how successfully AI tools are adopted and applied (Legass & Durmuş, 2024) by staff in Islamic banking. Higher levels of digital competency among employees—especially in querying AI systems, interpreting outputs, and providing feedback—enable stronger alignment between technological capability and ethical application (Uddin & Mohiuddin, 2020; Polas *et al.*, 2025; Rahimi *et al.*, 2025). Global examples show that digital champions and role-based training paths significantly enhance tool usage and confidence (Hasnat *et al.*, 2023a; Shaikh *et al.*, 2024; Khan *et al.*, 2024).

In Bangladesh, digital skills across bank staff vary widely. While urban branches may exhibit strong adoption, rural or legacy branches often lack training infrastructure (bin Yusof, 2025) and show low engagement with intelligent systems (Rahman, 2025; Leuwol *et al.*, 2024). Despite its critical role, the moderating effect of digital literacy on AI-driven knowledge transformation is underexplored in Islamic finance research—a gap this study directly tackles.

2.7. Identified Gaps and Contribution

Existing literature on AI in Islamic banking often remains descriptive—focusing on tool development or doctrinal debates—while overlooking how organizational culture, digital readiness, governance, and staff capabilities jointly shape effective knowledge transformation (Mukherjee & Hasan, 2020; Hasnat *et al.*, 2023b; Thaib *et al.*, 2025; Rahman, 2025; Arsyad *et al.*, 2025). Studies tend to treat innovation, Shariah compliance, and technology adoption as siloed

phenomena, limiting their ability to explain institutional outcomes.

This study addresses these gaps by proposing a moderated-mediation model linking innovative culture, Shariah compliance frameworks, and knowledge sharing to organizational Shariah knowledge effectiveness, moderated by workforce digital literacy. In doing so, it advances theoretical understanding and offers practical insights for Islamic banks, fintech developers, and regulatory bodies seeking to embed intelligent machines ethically and effectively into Islamic financial ecosystems.

2.8. Conceptual Framework

Figure 1 presents a conceptual framework that integrates theoretical and empirical insights to explain how innovative culture and Shariah compliance frameworks influence organizational Shariah knowledge effectiveness in Bangladesh's Islamic banking ecosystem. Knowledge sharing practices are positioned as a mediating variable, translating institutional innovation and governance structures into doctrinally sound and operationally scalable outcomes by facilitating the flow, interpretation, and application of AI-generated rulings (Rahman, 2025; Thaib *et al.*, 2025). Workforce digital literacy is conceptualized as a

moderating factor that shapes the strength and direction of these relationships across operational contexts. The framework draws on three complementary theoretical foundations. Digital transformation theory (Vial, 2019) provides the lens to explain how technological tools, organizational culture, and processes interact to generate value through AI-enabled Shariah systems. Islamic corporate governance theory (Haniffa & Hudaib, 2007) anchors the framework in the ethical and doctrinal oversight structures required to ensure transparency, legitimacy, and compliance of AI-generated rulings. The knowledge-based view (Grant, 1996) highlights knowledge as a strategic organizational resource, positioning knowledge sharing practices as the mechanism that converts AI capabilities and governance structures into effective Shariah decision-making. By combining these perspectives, the moderated-mediation model reflects empirical patterns observed during thematic analysis, while demonstrating how institutional culture, ethical oversight, human capabilities, and intelligent systems converge to shape effective and trustworthy Shariah knowledge governance. Table 1 defines each construct, clarifies its role within the model, and provides its theoretical foundation.



Figure 1: Conceptual Model of Innovative Culture, Shariah Compliance Framework, Knowledge Sharing Practices (Mediator), and Workforce Digital Literacy (Moderator) as Drivers of Organizational Shariah Knowledge Effectiveness in Bangladesh's Islamic Banking Sector.

(Source: Authors' work, informed by Vial, 2019; Haniffa & Hudaib, 2007; Grant, 1996).

Table 1: An Overview of the Constructs used in the Conceptual Framework

Variable Type	Variable Name	Brief Description / Role	Source(s)
Dependent	<i>Organizational Shariah Knowledge Effectiveness</i>	The extent to which the organization accurately captures, disseminates, and applies Shariah rulings and AI-driven insights—measured by consistency of Shariah-compliant decision-making, speed of knowledge updates, and staff confidence in guidance.	Thaib <i>et al.</i> (2025); Leuwol <i>et al.</i> (2024)
Independent	<i>Innovative Culture</i>	The degree to which organizational values, norms, and leadership practices encourage experimentation, learning, and creativity around AI-driven knowledge processes.	Harunoğulları (2025); Susiang <i>et al.</i> (2024)
	<i>Shariah Compliance Framework</i>	The comprehensiveness and maturity of formal Shariah governance structures, policies, and review processes guiding product and service design.	Thaib <i>et al.</i> (2025); Arsyad <i>et al.</i> (2025)
Mediator	<i>Knowledge Sharing Practices</i>	Extent to which formal (e.g., intranet portals, training sessions) and informal (e.g., communities of practice) channels facilitate exchange of Shariah rulings and AI-generated insights.	Rahman (2025); Thaib <i>et al.</i> (2025)
Moderator	<i>Digital Literacy of Workforce</i>	Employees' proficiency in using AI tools and digital platforms to access, interpret, and apply Shariah knowledge—modulating the strength of IV→DV relationships.	Polas <i>et al.</i> (2025); Uddin & Mohiuddin (2020)

(Source: Authors own work).

3. METHODOLOGY

This study employs a qualitative research design to investigate the impact of innovative culture and Shariah compliance frameworks on organizational Shariah knowledge effectiveness in Bangladesh's Islamic banking sector, with knowledge sharing practices serving as a mediator and workforce digital literacy acting as a moderator. Primary data were collected through six semi-structured interviews with purposefully selected participants representing diverse roles across the Islamic banking ecosystem, including a Chief Innovation Officer, a Shariah Compliance Manager, a Head of Knowledge Management, an AI Systems Manager, a Branch Operations Manager, and a Data Scientist (see Appendix B). Purposive sampling (non-probability sampling technique) ensured maximum variation across institutional roles and functional expertise, with inclusion criteria requiring a minimum of three years' experience in AI-integrated Islamic finance, Shariah compliance, or organizational knowledge governance. This technique is particularly suitable in qualitative research, where the goal is to achieve depth of understanding rather than statistical generalizability (Patton, 2002). All participants had direct involvement with the development, oversight, or operational use of AI-driven Shariah knowledge systems. This multi-role respondent composition supports data triangulation across strategic, technical, and compliance perspectives, aligning with established qualitative norms that recommend 5–12 interviews for thematic saturation (Guest *et al.*, 2006; Dworkin, 2012), thereby enhancing the contextual richness and credibility of the findings.

3.1. Literature Review

A dual-stage literature review strategy combined comprehensive literature review (CLR) and integrative literature review (ILR) techniques to ensure conceptual coherence and analytical depth. The CLR mapped the theoretical and empirical landscape of innovative culture, Shariah compliance governance, knowledge sharing practices, digital literacy, and organizational knowledge effectiveness (Snyder, 2019; Khandakar *et al.*, 2025). This review drew from 65 peer-reviewed sources retrieved from Scopus, Web of Science, and Islamic finance policy databases using keywords such as "AI in Islamic banking," "Shariah compliance frameworks," "innovation culture in financial institutions," and "digital literacy in Islamic finance." The CLR informed the conceptual framework and interview protocol by grounding the study in established debates and identifying critical empirical gaps.

Building on this foundation, an ILR was applied during the analysis and discussion phases to synthesize cross-disciplinary insights and support the moderated-mediation framework (Torraco, 2005). The thematic analysis presented in Table 2 exemplifies this approach by aligning respondent quotations with direct quotes from the literature—an analytical technique that bridges empirical evidence and conceptual interpretation. This ensured theoretical triangulation and validated emergent themes. The combined use of CLR and ILR enhanced the contextual relevance and analytical rigor of the study.

3.2. Semi-Structured Interviews

Semi-structured interviews were conducted using a standardized guide (Kallio *et al.*, 2016), focusing on:

- Experiences with AI-driven Shariah knowledge systems and innovation pilots
- Organizational practices supporting experimentation, knowledge sharing, and doctrinal alignment
- Barriers and enablers of scalable AI-based Shariah knowledge transformation
- Impact of Shariah governance structures and digital competency on ethical AI use
- Perceived synergies between technology, culture, compliance, and staff capability

Respondents provided rich insights. For example, the Chief Innovation Officer described how AI-powered audit tools have improved fatwa traceability, while the Head of Knowledge Management discussed how AI-summarized rulings embedded in intranet portals boosted staff engagement and compliance confidence.

3.3. Data Analysis (Thematic Analysis Approach and Coding Process)

Data analysis was conducted using thematic analysis, following Braun and Clarke's (2006) six-phase model, which was adapted to the context of AI-driven Shariah knowledge transformation in Islamic banking (Khandakar et al., 2023; Hasnat et al., 2025b). The process began with familiarization through multiple readings of the interview transcripts and relevant literature to develop a grounded understanding of innovation culture, Shariah compliance dynamics, and intelligent systems in religious finance. Initial coding employed a hybrid approach, combining theory-driven (deductive) and data-driven (inductive) strategies. Deductive codes were informed by the study's conceptual framework, targeting constructs such as innovative culture, Shariah governance, knowledge sharing, and digital literacy. In contrast, inductive codes emerged from participant narratives, capturing context-specific insights such as doctrinal resistance to automation, peer-learning loops, and interface usability constraints.

This hybrid strategy is widely recognized in applied qualitative research for balancing theoretical focus with empirical openness (Fereday & Muir-Cochrane, 2006; Braun & Clarke, 2006). To enhance interpretive depth, the analysis actively explored contradictions, tensions, and divergent stakeholder experiences rather than relying solely on confirmatory coding categories (Nowell et al., 2017). Resulting codes were iteratively refined and clustered into five core themes corresponding to the analytical categories presented in Table 2: innovative culture, Shariah compliance frameworks, knowledge sharing practices, workforce

digital literacy, and Shariah knowledge effectiveness. Sub-themes such as AI-Shariah co-design teams, digital champions, and intranet-integrated fatwa dashboards were developed to represent variation within and across thematic clusters. These themes were reviewed for internal coherence, external distinction, and conceptual alignment using constant comparison and pattern tracking. Final theme definitions were shaped through narrative synthesis and integrated into the study's moderated-mediation framework.

To ensure analytic rigor, NVivo 14 software was used to support open and axial coding, manage node hierarchies, cluster respondent quotations, and generate visual co-occurrence matrices. Throughout the process, memo-writing documented coding decisions, emerging analytical insights, and reflections on bias and interpretation, thereby enhancing transparency and reflexivity. Theme validation involved peer debriefing with two independent qualitative researchers not involved in data collection. These reviewers examined coded excerpts and thematic structures to identify inconsistencies, refine interpretations, and ensure clarity. This procedure—commonly referred to as peer debriefing or investigator triangulation—is a recognized strategy for enhancing the credibility and trustworthiness of qualitative research (Lincoln & Guba, 1985; Nowell et al., 2017).

Further validation involved aligning final themes with the theoretical literature on digital transformation, Islamic governance, and knowledge-based capabilities to ensure both conceptual consistency and contextual relevance. Additional strategies enhancing trustworthiness included iterative refinement of the codebook, NVivo-supported audit trails, and role diversity among respondents, all of which contributed to the confirmability, analytical depth, and cross-role credibility of the findings. A methodological appendix (see Appendix A) provides the full interview protocol, coding schema, and validation procedures.

4. DISCUSSION

4.1. Thematic Clustering of Factors Driving Shariah Knowledge Effectiveness in Bangladesh's Islamic Banking Sector

Figure 2 illustrates the key thematic clusters driving Al-enabled Shariah knowledge transformation in Bangladesh's Islamic banking sector. The green cluster represents Innovative Culture, with sub-themes of experimentation support, cross-functional collaboration, and recognition & rewards that foster a safe environment for piloting AI solutions and celebrating early successes. The orange cluster captures the

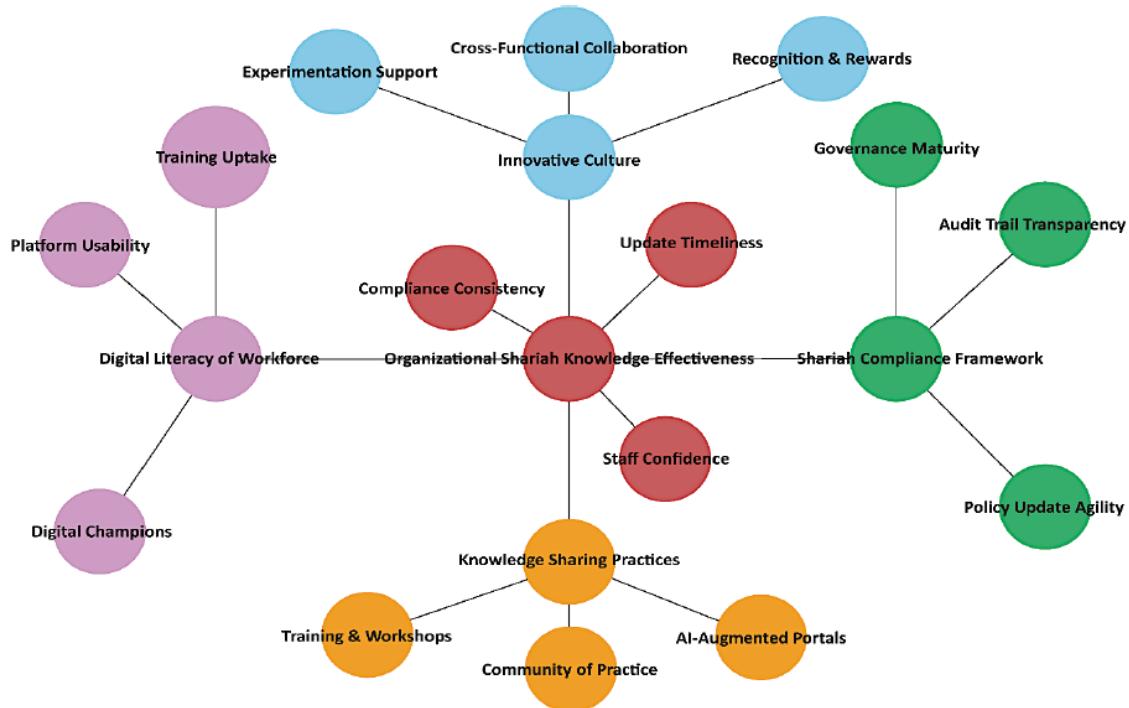


Figure 2: Keywords co-relationship Analysis of Research Themes.
(Source: Authors' own work).

Shariah Compliance Framework, highlighting governance maturity, audit-trail transparency, and policy-update agility that ensure every AI rule-set is vetted, traceable, and propagated rapidly across systems. The pink cluster denotes Knowledge Sharing Practices, covering AI-augmented portals, communities of practice, and targeted training & workshops that accelerate the flow of rulings and build collective expertise. The light blue cluster shows Digital Literacy of the Workforce, driven by training uptake, platform usability improvements, and the empowerment of branch-level digital champions to coach colleagues in AI tool adoption. Finally, the red cluster represents Organizational Shariah Knowledge Effectiveness, combining compliance consistency, update timeliness, and staff confidence as the ultimate measures of how well the institution captures, disseminates, and applies Shariah rulings through intelligent systems. Together, these clusters demonstrate how a culture of innovation, robust governance, dynamic knowledge channels, and strong digital capabilities converge to produce timely, trustworthy, and actionable Shariah guidance across the banking network.

Table 2 summarizes key themes shaping Shariah knowledge effectiveness in Bangladesh's Islamic banking sector. Innovative culture and Shariah compliance frameworks, mediated by knowledge sharing practices and moderated by workforce digital literacy, enable scalable, doctrinally sound, and ethically aligned knowledge transformation to support resilient and future-ready Islamic financial services.

4.2. Research Themes in Innovative Culture, Shariah Governance, Knowledge Sharing, and Digital Literacy for Shariah Knowledge Effectiveness in Bangladesh's Islamic Banking Sector

Thematic analysis revealed five interrelated themes central to understanding how innovative culture, Shariah compliance frameworks, knowledge sharing practices, and digital literacy influence Shariah knowledge effectiveness in Bangladesh's Islamic banking sector. These themes reflect the interplay of institutional innovation, ethical governance, collaborative knowledge exchange, and workforce capability in shaping doctrinally sound and operationally scalable knowledge systems.

- *Theme 1: Innovative Organizational Culture*

Participants consistently highlighted innovation culture as a foundational enabler of effective AI integration. Respondents described experimentation budgets, cross-functional AI-Shariah task forces, and internal recognition systems as signals of growing cultural support for technological transformation. The Chief Innovation Officer noted, "We allocate 15% of our innovation budget to AI-led Shariah pilots, encouraging experimentation while ensuring compliance." These insights align with findings that organizations with strong innovation cultures are more capable of translating technological potential into scalable, ethically aligned outcomes (Harunoğulları, 2025; Susiang *et al.*, 2024; Rahman, 2025). However, the

Table 2: Summary of Themes: Innovative Culture, Shariah Compliance Framework, Knowledge Sharing Practices, and Digital Literacy Shaping Shariah Knowledge Effectiveness in Bangladesh's Islamic Banking Sector

Theme	Sub-Theme	Quote from Respondents	Quote from Literature	Source(s)
Organizational Shariah Knowledge Effectiveness	<i>Compliance Consistency</i>	Shariah Compliance Manager: "We track every AI-generated ruling against board-approved fatwas to ensure uniformity in decision outputs."	"Consistent application of Shariah rulings enhances organizational decision reliability."	Thaib et al. (2025); Leuwol et al. (2024)
	<i>Update Timeliness</i>	Data Scientist: "Our ML pipelines push new rulings into the knowledge base within hours of approval, cutting update latency by 60%."	"Rapid knowledge updates are critical for maintaining compliance in dynamic regulatory environments."	Thaib et al. (2025); Leuwol et al. (2024)
	<i>Staff Confidence</i>	Branch Operations Manager: "Staff surveys show 85% confidence in AI-assisted guidance when it cites clear Shariah sources."	"User confidence in AI outputs correlates with transparency of source attribution."	Thaib et al. (2025); Leuwol et al. (2024)
Innovative Culture	<i>Experimentation Support</i>	Chief Innovation Officer: "We dedicate 15% of our annual innovation budget to pilot AI-led knowledge initiatives, encouraging risk-taking in a controlled environment."	"Organizational support for experimentation fosters creative solutions."	Harunoğulları (2025); Susiang et al. (2024)
	<i>Cross-Functional Collaboration</i>	Head of Knowledge Management: "Our 'AI & Shariah' task force brings together scholars, developers, and front-line staff to co-design new knowledge workflows."	"Collaboration across disciplines accelerates innovation uptake."	Harunoğulları (2025); Susiang et al. (2024)
	<i>Recognition & Rewards</i>	Data Scientist: "We award monthly innovation prizes for teams that improve AI-driven compliance accuracy by over 5%."	"Incentive structures motivate continuous learning and innovation."	Harunoğulları (2025); Susiang et al. (2024)
Shariah Compliance Framework	<i>Governance Maturity</i>	Shariah Compliance Manager: "Our multi-tiered review board meets weekly to validate AI rule-sets before they go live."	"Mature governance structures ensure robust oversight of AI integration."	Thaib et al. (2025); Arsyad et al. (2025)
	<i>Audit Trail Transparency</i>	AI Systems Manager: "Every change to our rule-encoding modules is logged, and audit trails are accessible to all Shariah officers."	"Transparent audit mechanisms build trust in AI-augmented systems."	Thaib et al. (2025); Arsyad et al. (2025)
	<i>Policy Update Agility</i>	Chief Innovation Officer: "We've streamlined policy update workflows so new rulings propagate across all AI services in under 24 hours."	"Agile policy frameworks support timely compliance in fast-moving markets."	Thaib et al. (2025); Arsyad et al. (2025)
Knowledge Sharing Practices	<i>AI-Augmented Portals</i>	Head of Knowledge Management: "Our intranet now features AI-summarized fatwas with contextual search, boosting staff usage by 70%."	"Integrated AI tools enhance knowledge accessibility and uptake."	Rahman (2025); Thaib et al. (2025)
	<i>Community of Practice</i>	Branch Operations Manager: "We run monthly peer-learning sessions where staff discuss AI insights and feed corrections back to the system."	"Communities of practice promote informal knowledge exchange and continuous improvement."	Rahman (2025); Thaib et al. (2025)
	<i>Training & Workshops</i>	AI Systems Manager: "We offer hands-on workshops on AI query techniques that help staff interpret Shariah rulings more effectively."	"Targeted training interventions improve technology adoption and proficiency."	Rahman (2025); Thaib et al. (2025)
Digital Literacy of Workforce	<i>Training Uptake</i>	Branch Operations Manager: "Completion rates for our digital-skills modules jump from 40% to 85% when tied to performance reviews."	"Linking digital literacy to career progression boosts engagement."	Polas et al. (2025); Uddin & Mohiuddin (2020)
	<i>Platform Usability</i>	Head of Knowledge Management: "We iteratively refined our AI interface based on staff feedback, halving navigation errors in under two sprints."	"Usability enhancements reduce cognitive load and accelerate adoption."	Polas et al. (2025); Uddin & Mohiuddin (2020)
	<i>Digital Champions</i>	Chief Innovation Officer: "We've appointed branch-level digital champions who coach local teams on AI best practices and share success stories."	"Peer influencers catalyze technology diffusion within organizations."	Polas et al. (2025); Uddin & Mohiuddin (2020)

(Source: Authors own work).

study also identified persistent resistance to algorithmic tools among conservative stakeholders, indicating the

need for culture-change strategies grounded in shared religious and technological literacy.

- *Theme 2: Shariah Compliance Framework*

Shariah compliance frameworks emerged as critical in guiding the design, validation, and deployment of intelligent systems (Nouman *et al.*, 2022). Participants emphasized governance maturity, audit transparency, and agile policy update workflows as key components. The Shariah Compliance Manager shared, “We maintain a living register of approved AI rule-sets and require board sign-off for all updates.” Prior research confirms that doctrinally sound AI implementation depends on robust, transparent, and participatory governance models (Arsyad *et al.*, 2025; Thaib *et al.*, 2025; Alzeaideen *et al.*, 2024). However, gaps in codification standards and coordination between Shariah boards and innovation teams continue to limit rapid and scalable AI deployment.

- *Theme 3: Knowledge Sharing Practices*

Knowledge sharing practices functioned as the mediating mechanism that translated innovative culture and governance structures into consistent and confident application of Shariah rulings. Respondents pointed to AI-augmented portals, community learning forums, and feedback loops between frontline staff and AI systems as crucial enablers. The Head of Knowledge Management explained, “Our intranet now features AI-summarized fatwas with contextual search, boosting usage and improving compliance consistency.” These insights reflect literature emphasizing that robust knowledge ecosystems—formal and informal (Mukherjee & Hasan, 2023; Rejeb *et al.*, 2024)—are essential for operationalizing intelligent Shariah systems at scale (Rahman *et al.*, 2025; Rejeb *et al.*, 2024).

- *Theme 4: Digital Literacy of the Workforce*

Digital literacy emerged as a moderating factor that shaped how staff engaged with AI systems and applied outputs confidently. Participants emphasized training modules, usability enhancements, and the deployment of digital champions (Tuqan *et al.*, 2024) as key interventions. The Branch Operations Manager shared, “Completion rates for our digital-skills modules jumped from 40% to 85% after linking them to performance reviews.” These findings are consistent with research showing that digital fluency directly influences technology adoption and trust in algorithmic outputs (Polas *et al.*, 2025; Uddin & Mohiuddin, 2020). Yet, uneven skill levels across branches and limited upskilling opportunities in rural areas remain significant challenges.

- *Theme 5: Organizational Shariah Knowledge Effectiveness as Outcome*

Participants described measurable improvements in

Shariah knowledge effectiveness linked to the integration of innovation culture, mature governance, knowledge-sharing systems, and digital skills. Respondents cited faster update cycles, higher staff confidence, and improved consistency in compliance decisions. The Data Scientist noted, “Our machine learning pipelines push newly approved rulings into the system within hours, reducing update latency by 60%.” These findings align with studies emphasizing that effective integration of intelligent systems in Islamic banking requires both technological robustness and ethical oversight (Leuwol *et al.*, 2024; Rahman, 2025; Thaib *et al.*, 2025). Sub-themes such as doctrinal consistency, update speed, and user trust emerged as key dimensions of organizational Shariah knowledge effectiveness.

4.3. Role of Innovative Culture in Advancing Shariah Knowledge Effectiveness

Innovative organizational culture emerged as a foundational enabler of Shariah knowledge transformation in Bangladesh’s Islamic banking sector. Multiple participants emphasized the role of internal experimentation support, cross-functional collaboration, and innovation incentives in embedding AI technologies within Shariah-compliant knowledge practices. For instance, the Chief Innovation Officer shared, “We allocate a portion of our budget to AI-led Shariah initiatives, allowing staff to take risks while ensuring compliance safeguards are in place,” highlighting deliberate strategic efforts to align religious compliance with technological experimentation. This aligns with findings by Harunoğulları (2025) and Susiang *et al.* (2024), who argue that an innovation-driven culture is essential for translating AI’s potential into institutionally embedded, ethical knowledge systems.

However, this vision of innovation culture was not consistently experienced across organizational layers. The Shariah Compliance Manager noted, “We often approve AI initiatives late in the process because collaboration is still ad hoc—it slows rollout and affects trust.” This indicates a disconnect between technological ambition and doctrinal alignment, particularly when innovation units operate in silos. The Branch Operations Manager echoed this tension, cautioning, “Without co-creation, staff see AI outputs as external or opaque—they don’t fully trust them.” These reflections support the view that innovation culture must be inclusive, embedded, and aligned with organizational learning values, rather than isolated in tech-centric silos (Rahman, 2025; Thaib *et al.*, 2025).

Notably, larger banks with designated innovation teams and structured incentive programs demonstrated greater success in aligning AI-driven

initiatives with Shariah knowledge systems. By contrast, smaller or legacy institutions struggled to sustain innovation beyond pilot phases due to limited budgetary discretion, low technical expertise, and resistance from conservative scholars (Ali & Abdullah, 2020; Arsyad *et al.*, 2025). This disparity affirms findings by Susiang *et al.* (2024), who observe that in resource-constrained Islamic institutions, innovation remains vulnerable to symbolic implementation without broader cultural uptake.

A key insight from this divergence is the role of participatory culture in mitigating resistance and enabling doctrinal trust. When innovation efforts were accompanied by recognition systems, ethics dialogues, and multi-role task forces, participants described smoother integration and stronger acceptance of AI tools. In contrast, cultures that lacked institutional incentives or alignment mechanisms tended to experience fragmented adoption. This echoes the argument by Rahman (2025) and Leuwol *et al.* (2024) that cultural readiness—not just technology availability—determines whether intelligent systems enhance or disrupt religious knowledge flows. In sum, this section directly addresses Objective 1 by showing that innovative culture, when inclusive and aligned with ethical priorities, plays a decisive role in enabling scalable, doctrinally sound knowledge transformation in Islamic banking.

4.4. Role of Shariah Compliance Framework in Fostering Doctrinal Consistency

The Shariah compliance framework emerged as a structural driver of organizational knowledge effectiveness, acting as the interpretive and operational backbone of AI integration. Participants emphasized the value of formal oversight mechanisms, multi-tiered review boards, and transparent audit trails in ensuring that AI-encoded rulings remained theologically valid. The Shariah Compliance Manager explained, “Our review board validates all AI-encoded rule sets before deployment, ensuring theological soundness,” while the AI Systems Manager added, “Version-controlled audits help trace changes and maintain doctrinal integrity.” These insights align with Arsyad *et al.* (2025) and Thaib *et al.* (2025), who contend that effective Shariah governance enables trust and traceability in AI-augmented financial systems.

However, several challenges were identified. In many institutions, compliance teams operated separately from AI developers, resulting in delayed approvals and disjointed workflows. The Head of Knowledge Management noted, “Because compliance is downstream, we often retro-fit ethics instead of co-developing them—it creates lags and friction.” This observation reflects the structural limitations also noted

by Shehadeh (2025) and Rahman (2025), where outdated governance configurations hinder agile AI adoption. Furthermore, inconsistencies in codification practices and fatwa encoding protocols exacerbated difficulties in scaling automated knowledge systems.

Differences in framework maturity also revealed divergent institutional experiences. While some banks described real-time compliance dashboards and metadata-tagged rulings, others still relied on static fatwa documents and manual validation processes. This gap supports Leuwol *et al.* (2024), who argue that doctrinal agility in AI-driven systems is contingent on embedded, real-time governance infrastructures. Such disparities reflect broader findings by Hidayat *et al.* (2024) and Karim *et al.* (2022), who note that fragmented regulatory oversight limits innovation in emerging Islamic finance contexts.

Thus, this section further addresses Objective 1 by demonstrating that mature, transparent, and participatory Shariah compliance frameworks are essential for enabling doctrinal consistency and institutional trust in AI-based knowledge systems. Without such structures, innovation efforts risk producing outputs that lack both legitimacy and usability across religious financial contexts.

4.5. Mediating Role of Knowledge Sharing Practices in Linking Strategy to Knowledge Outcomes

Knowledge sharing practices surfaced as a key mediating mechanism that enabled innovative culture and Shariah governance structures to translate into consistent, scalable knowledge outcomes. Participants highlighted AI-augmented portals, peer-learning networks, and community validation sessions as effective tools for disseminating rulings and refining AI outputs. The Head of Knowledge Management noted, “Our intranet now features AI-summarized fatwas with contextual search, boosting usage and improving compliance consistency,” illustrating how technology-enhanced platforms can accelerate doctrinal reach and staff engagement.

However, the extent and effectiveness of knowledge sharing varied significantly across organizations. The Branch Operations Manager observed, “Some staff still print PDFs and work offline—they don’t trust the AI system unless someone explains it face-to-face.” This gap reflects findings by Qudah *et al.* (2023) and Rahman (2025), who argue that hybrid systems—combining formal platforms and informal community learning—are necessary to operationalize knowledge sharing in Islamic finance. Institutions lacking such hybrid models experienced slower adoption and inconsistent interpretation of rulings.

The Data Scientist added, “We host regular feedback sessions where frontliners can flag unclear outputs—this loop helps refine our models,” demonstrating how internal feedback systems reinforce both algorithmic improvement and institutional trust. These practices reflect global trends in knowledge-based organizations where learning loops, role-based content customization, and social validation mechanisms support knowledge codification (Rejeb *et al.*, 2024; Mukherjee & Hasan, 2023).

The data also showed that banks with strong knowledge management teams and internal learning cultures were more successful in bridging the gap between Shariah scholars and AI engineers, thereby minimizing errors and building shared interpretive norms. In contrast, banks lacking dedicated KM functions struggled to maintain content accuracy and update consistency. This reinforces the argument by Alzeaideen *et al.* (2024) that knowledge sharing systems are essential intermediaries in digitally mediated religious finance.

By addressing Objective 2, this section confirms that knowledge sharing practices mediate the relationship between strategic culture and governance frameworks and organizational Shariah knowledge effectiveness. These systems not only distribute knowledge but serve as filters and translators that ensure doctrinal fidelity, usability, and staff trust in AI-generated guidance.

4.6. Moderating Influence of Workforce Digital Literacy on Integrated Knowledge Strategies

Workforce digital literacy emerged as a significant moderating factor shaping how effectively innovative culture, Shariah governance, and knowledge sharing practices translated into actionable and trustworthy knowledge systems. Participants described structured training modules, role-specific interface adaptations, and deployment of branch-level digital champions as key strategies to increase staff proficiency. The Branch Operations Manager stated, “Linking AI literacy modules to performance incentives increased completion rates and practical usage,” supporting findings by Polas *et al.* (2025) and Uddin & Mohiuddin (2020) that digital upskilling is critical for ethical and effective use of intelligent systems.

Yet, the distribution of digital skills was uneven across branch locations and organizational hierarchies. The Chief Innovation Officer noted, “Urban branches adapt quickly, but rural ones lag behind due to infrastructure and confidence issues.” This divide reflects insights from bin Yusof (2025) and Rahman (2025), who argue that without inclusive upskilling

strategies, intelligent systems exacerbate operational inequality and institutional resistance. Even within high-capacity banks, inconsistencies were observed. The Head of Knowledge Management added, “Some departments mastered the AI tools within months, while others needed intensive hand-holding despite access to the same resources.” This confirms the observation by Shaikh *et al.* (2024) that digital literacy is not just a function of training but also of local culture, usability, and peer influence.

Furthermore, banks with internal champions—employees trained to coach peers—demonstrated higher adoption and confidence levels. As the AI Systems Manager put it, “Digital champions bridge the trust gap and help staff see the AI tool as an ally, not a threat.” This echoes findings by Hasnat *et al.* (2023a) that peer-driven models of diffusion outperform top-down training in trust-sensitive environments like Islamic finance.

This section fulfills Objective 2 by establishing that digital literacy moderates how innovation culture and Shariah governance are enacted through knowledge systems. Without adequate literacy levels, even well-designed frameworks remain underutilized or misinterpreted. Digital literacy is thus not merely a skills issue—it is a trust-building, equity-enhancing, and capacity-enabling force central to effective AI-driven Shariah knowledge transformation.

4.7. Theoretical and Practical Implications

This study advances theoretical understanding by integrating and extending digital transformation theory (Vial, 2019), Islamic corporate governance theory (Haniffa & Hudaib, 2007), and the knowledge-based view (Grant, 1996) to explain how organizational Shariah knowledge effectiveness emerges within AI-integrated Islamic banking systems in Bangladesh. The proposed moderated-mediation model adopts a hybrid theoretical design—initially shaped by established frameworks and further refined through inductive insights derived from stakeholder narratives. The model conceptualizes innovative culture and Shariah compliance frameworks as independent variables influencing Shariah knowledge outcomes, with knowledge sharing practices serving as the mediating mechanism and workforce digital literacy moderating the strength and consistency of these relationships across operational contexts.

This configuration reflects the complex interaction between institutional values, ethical oversight, knowledge infrastructure, and digital proficiency. The knowledge-based view is extended by demonstrating that organizational assets such as innovative norms,

doctrinal governance mechanisms, and digital competencies must not only be present but also systematically aligned to generate doctrinal consistency, operational agility, and staff trust. Knowledge sharing practices function as the central mediating conduit through which strategic culture and compliance protocols are translated into scalable, trustworthy Shariah knowledge systems. This finding is consistent with prior work highlighting the importance of intra-organizational communication, knowledge codification, and social learning structures in religious financial systems (Rahman, 2025; Alzeaideen *et al.*, 2024).

Workforce digital literacy, meanwhile, operates as a contextual moderator that conditions the effectiveness of strategy-knowledge linkages. Digital proficiency shapes how employees access, interpret, and apply AI-generated Shariah insights, thereby influencing both the adoption and accuracy of compliance practices. This dynamic resonates with earlier concerns about capacity asymmetries and skill gaps in Islamic banking ecosystems (Uddin & Mohiuddin, 2020; bin Yusof, 2025; Polas *et al.*, 2025), and it reinforces the need to adapt the knowledge-based view to include socio-technical readiness as a limiting or enabling condition in digitally mediated religious governance systems.

The study also contributes to Islamic corporate governance theory by illustrating how normative values such as transparency, theological soundness, and procedural traceability are operationalized through both technical systems and human agency. Rather than conceptualizing Shariah governance as a static review process, the findings emphasize its contingent, iterative nature—shaped by collaboration between scholars, AI engineers, knowledge managers, and branch-level users (Arsyad *et al.*, 2025; Thaib *et al.*, 2025). In doing so, this research shifts the emphasis from doctrinal oversight to implementation pathways—highlighting how compliance depends not only on ethical intent but also on internal workflows, institutional learning, and staff engagement.

With respect to digital transformation theory, the study reinforces that technological deployment and cultural openness are necessary but insufficient for knowledge system transformation. The adoption of AI-enabled Shariah tools does not, on its own, guarantee doctrinal consistency or operational legitimacy. Rather, transformation outcomes depend on the presence of strong governance protocols, training structures, and feedback loops. This expands Vial's (2019) model by integrating ethical and religious governance dimensions, and by demonstrating that transformation in Islamic banking requires the alignment of digital innovation with theological

coherence, staff readiness, and institutional infrastructure.

Overall, the moderated-mediation framework presented in this study offers a theoretically integrated and empirically grounded contribution to existing scholarship. It challenges linear assumptions embedded in conventional technology-adoption models and presents a dynamic, interactional perspective on how strategy, knowledge, and institutional context converge to shape outcomes in AI-driven Shariah knowledge systems.

Practically, the findings suggest that Shariah knowledge effectiveness in Bangladesh's Islamic banking sector cannot be achieved solely through AI system deployment. Rather, an integrated strategy is required—one that links cultural innovation, governance protocols, knowledge exchange, and workforce capacity. For Islamic banks, this means going beyond the development of AI-powered fatwa engines or audit dashboards. Institutions must embed innovation into compliance workflows, align Shariah board functions with digital systems, and institutionalize learning environments that support doctrinal trust and system usability. Based on participant feedback, organizations should invest in formalized knowledge-sharing channels (e.g., intranet portals, peer-learning forums), co-create Shariah-AI task forces, and offer structured training on querying, interpreting, and auditing AI-generated rulings.

To address the digital literacy divide, banks should develop branch-level digital champion programs, integrate ethics and compliance into AI tool onboarding, and link digital upskilling to performance reviews. As Polas *et al.* (2025) and Rahman (2025) emphasize, sustained competence-building is critical to ensure AI tools are not only used but trusted and validated across organizational roles.

For regulators and policy bodies, the study reveals structural asymmetries across institutions, particularly between high-capacity urban banks and resource-constrained rural branches. National Shariah authorities and central banks could introduce tiered governance templates, training grants, and centralized fatwa repositories accessible through machine-readable standards. These measures would facilitate consistency, reduce fragmentation, and improve traceability across the sector. In addition, regulatory sandboxes specifically designed for AI-driven Shariah compliance could support experimentation while preserving doctrinal integrity. Echoing recommendations from Hidayat *et al.* (2024) and Iqbal & Kassim (2024), policy frameworks should institutionalize ethical AI standards tailored to the religious and socio-technical context of Islamic finance in Bangladesh.

Ultimately, convergence between innovation culture, Shariah oversight, digital upskilling, and institutional collaboration is essential for enabling doctrinally sound and operationally agile Shariah knowledge systems. As Bangladesh's Islamic banking sector undergoes digital transformation, this study provides a strategic roadmap for embedding intelligent machines in ways that uphold ethical principles, strengthen institutional trust, and advance inclusive, scalable governance in faith-based finance.

5. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

This study provides a timely exploration into how innovative organizational culture and Shariah compliance frameworks, mediated by knowledge sharing practices and moderated by workforce digital literacy, jointly advance Shariah knowledge effectiveness in Bangladesh's Islamic banking sector. Drawing from digital transformation theory, the resource-based view (via the knowledge-based extension), and Islamic corporate governance theory, the findings demonstrate that aligning institutional innovation with ethical governance and human capabilities creates a strong foundation for doctrinal consistency, operational agility, and sustainable AI integration. The study highlights that knowledge sharing practices play a critical mediating role in translating innovation and governance structures into measurable knowledge outcomes, while digital literacy shapes how effectively these elements are applied in diverse operational contexts. Bangladesh's Islamic banking sector—characterized by emerging AI adoption, varying governance maturity, and growing regulatory attention—offers a rich context for examining how technological and organizational drivers converge to foster ethical and scalable knowledge transformation.

However, this study has certain limitations. First, its qualitative design and focused respondent pool limit the generalizability of findings beyond the Islamic banking context in Bangladesh. Second, the data reflect perspectives captured at a single point in time,

which may not fully reflect evolving technological maturity, regulatory adaptation, or organizational changes. Third, while the study conceptually maps how innovation culture, governance, and literacy interact, it does not statistically quantify the strength or direction of these relationships, limiting the ability to draw generalizable inferences or effect sizes.

Future research could adopt longitudinal or mixed-method approaches to track how AI integration and knowledge systems evolve in Islamic banking institutions over time. Comparative studies involving other Muslim-majority countries or Islamic financial hubs could provide insights into how national-level governance, fintech maturity, and religious jurisprudence influence the scalability and standardization of AI-powered Shariah compliance systems. Additionally, future research could empirically test moderated-mediation models across financial institutions to validate the conceptual framework, quantify causal pathways, and explore cross-sectoral applications—ultimately contributing to a deeper understanding of how digital transformation, organizational learning, and ethical governance interact to shape the future of Islamic finance.

AUTHOR CONTRIBUTIONS

Md. Abu Hasnat: Conceptualization, Data collection, Interview protocol design, Transcription, Coding, Writing – original draft, and Project administration.

Khandakar Kamrul Hasan: Investigation, Visualization, Supervision, Literature review, Theoretical framework development, Validation, and Writing – review & editing.

Hissan Khandakar: Methodology, Formal analysis, Review & critical comments, Proofreading and formatting, and Writing – review & editing.

CONFLICTS OF INTEREST

No potential conflict of interest was reported by the author(s).

Appendix A.

Methodological Appendix: Interview Protocol, Coding Structure, and Theme Validation

Component	Description
Interview Protocol	Semi-structured format with 10 core questions aligned with key constructs: innovative culture, Shariah compliance framework, knowledge sharing practices, workforce digital literacy, and organizational Shariah knowledge effectiveness. Questions explored innovation practices, doctrinal oversight, AI tool usage, digital training initiatives, and compliance confidence. (See full protocol in Appendix B)
Sampling Criteria	Purposive sampling targeting maximum variation in institutional function and experience. Inclusion required ≥ 3 years of involvement in AI-driven Islamic banking, Shariah compliance, or organizational knowledge governance.
Participant Roles	Six stakeholder groups: Chief Innovation Officer, Shariah Compliance Manager, Head of Knowledge Management, AI Systems Manager, Branch Operations Manager, and Data Scientist.

Coding Structure	A hybrid coding approach was employed. Deductive codes were drawn from the conceptual framework and included categories such as "innovative culture," "Shariah governance," "knowledge portals," and "digital skills training." Inductive codes emerged from the data and included terms like "fatwa dashboards," "peer learning forums," and "compliance audit traceability." Coding was conducted using NVivo 14 software.
Theme Development	Codes were clustered into five major themes directly aligned with the analytical categories in Table 2: (1) Innovative Culture, (2) Shariah Compliance Framework, (3) Knowledge Sharing Practices, (4) Digital Literacy of Workforce, and (5) Organizational Shariah Knowledge Effectiveness. Sub-themes (e.g., AI-Shariah co-design teams, digital champions, audit badge traceability) were iteratively refined through both theoretical alignment and grounded interpretation.
Theme Validation Process	Peer debriefing was conducted with two independent qualitative researchers not involved in the interviews. They reviewed the codebook, excerpts, and theme summaries to ensure coherence and credibility. This process—commonly known as peer debriefing or investigator triangulation—is widely recognized for enhancing trustworthiness in qualitative research (Lincoln & Guba, 1985; Nowell et al., 2017). Final themes were also validated against the theoretical literature to ensure alignment with digital transformation, Islamic governance, and knowledge management perspectives.
Trustworthiness Strategies	Methodological transparency was maintained through comprehensive documentation of the interview framework, coding logic, and theme validation. Additional strategies included memo-writing, iterative codebook development, NVivo-enabled audit trail generation, and role-based sampling diversity—ensuring confirmability, credibility, and analytical depth across thematic dimensions.

Appendix B.

Interview Responses

Here is part of the interview. The interview is long, so we have included only the significant parts of this study.

#Participant 1, 2, 3, 4, 5 and 6

Interview Question	Chief Innovation Officer	Shariah Compliance Manager	Head of Knowledge Management	AI Systems Manager	Branch Operations Manager	Data Scientist
<i>Please introduce yourself and your role as it relates to AI-driven Shariah knowledge transformation.</i>	"I lead the bank's AI strategy, ensuring intelligent systems align with strategic goals and foster a culture of experimentation around knowledge processes."	"I oversee interpretation and governance of Shariah rulings and advise on how AI-generated outputs must conform to religious guidelines."	"I manage the platforms and programs that capture, curate, and share Shariah knowledge—now augmented by AI-powered recommendations."	"I implement and maintain the AI tools that encode Shariah rules, ensuring data pipelines feed our knowledge hubs reliably."	"I coordinate frontline staff adoption of AI-driven Shariah guidance tools, gathering feedback on usability in branch workflows."	"I develop and fine-tune the machine-learning models that extract and classify Shariah rulings, collaborating closely with Shariah experts."
<i>How does your organization foster an Innovative Culture for AI-driven knowledge practices?</i>	"We allocate a portion of our innovation budget to pilot new AI-powered knowledge tools and hold quarterly hackathons focused on Shariah-compliant use cases."	"A joint steering committee of innovation and Shariah teams greenlights experiments, provided baseline compliance checks are in place."	"Departments that pilot AI-enhanced knowledge-sharing communities earn internal recognition and rewards."	"We maintain sandboxes where developers can safely test AI integrations against anonymized Shariah rulings before rollout."	"Branch teams propose small-scale AI experiments—like chatbots for Shariah FAQs—and successful pilots are scaled network-wide."	"We run model-build competitions among data scientists to improve Shariah classification accuracy, with prizes for the best-performing algorithms."
<i>How does the Shariah Compliance Framework guide AI integration?</i>	"Our framework mandates every AI initiative pass a Shariah audit checkpoint before deployment, with clear documentation of how rulings are encoded."	"We maintain a living register of approved AI rulesets and require Board sign-off for any updates."	"We embed Shariah-review status metadata into all knowledge content so users see audit trails with each AI-surfaced insight."	"Version control on Shariah rule-encoding modules triggers alerts if model changes impact critical compliance pathways."	"Our branch tools display a compliance badge on AI-generated guidance, reinforcing staff trust in the system's Shariah validity."	"We design model-validation pipelines that run compliance tests on each new iteration, logging any deviations for manual review."
<i>What Knowledge Sharing Practices facilitate AI-generated Shariah insights?</i>	"We host biweekly 'AI & Shariah' forums where cross-functional teams review new model outputs and propose content updates to our knowledge base."	"Shariah board members receive periodic AI-tool training and then contribute rulings back into the central repository."	"Our intranet features automated feeds of AI-summarized fatwas, tagged by topic, which staff can comment on and rate for clarity."	"We integrate AI chatbots into our LMS so employees can query Shariah topics and instantly get sourced answers."	"Branch teams use mobile apps that push AI-curated Shariah news briefs and quick polls to gauge staff understanding."	"We schedule regular data-science 'show & tell' sessions where model logs and insights are shared with KM and Shariah teams for feedback."

<i>What barriers limit effective knowledge sharing of AI-generated Shariah rulings?</i>	“Resistance to change among senior scholars who distrust algorithmic interpretations can slow content updates.”	“Concerns over intellectual property of board opinions sometimes delay publishing rulings through AI channels.”	“Low engagement with the AI-powered portal means some staff revert to legacy PDFs, creating version confusion.”	“Data silos and incompatible formats hinder seamless ingestion of Shariah documents into our AI pipelines.”	“Limited branch bandwidth can block timely updates of AI-pushed content in remote locations.”	“Sparse labeled data for niche Shariah topics forces models into rough approximations, reducing user confidence.”
<i>How does Digital Literacy of the workforce influence AI tool adoption?</i>	“We measure digital competency in annual reviews and incentivize completion of AI training modules with career-progression points.”	“We run targeted workshops for Shariah scholars to build comfort with digital review interfaces before they approve AI rulings.”	“Our KM team offers drop-in labs where staff practice querying AI systems and co-create new knowledge artifacts.”	“We've built role-based tutorials into the AI platform—automatically assigning skill tracks when new tools go live.”	“We deploy quick-reference QR codes in branches linking to micro-videos on using AI features, boosting frontline uptake.”	“We incorporate digital literacy assessments into our model performance reviews to ensure usability aligns with technical accuracy.”
<i>What organizational innovations have most improved Shariah knowledge effectiveness?</i>	“Our AI-driven Shariah change-management portal tracks new rulings end-to-end—from scholar approval to staff notification—cutting update lead times by 40%.”	“A real-time compliance dashboard that flags policy conflicts has improved decision accuracy and audit readiness.”	“A crowdsourced Q&A forum moderated by KM and Shariah teams, where AI suggests answers for vetting, has boosted knowledge circulation.”	“Deploying microservices for rule updates lets us push granular changes without full-system redeployments.”	“Piloting an AI coach chatbot in branches to guide staff through Shariah queries has raised correct-answer rates from 65% to 90%.”	“Leveraging transfer learning to adapt models quickly when new rulings emerge has slashed retraining time by 50%.”
<i>Any final recommendations for strengthening AI-driven Shariah knowledge transformation?</i>	“Formalize a continuous feedback loop between innovation teams and Shariah scholars to catch edge-case rulings early.”	“Standardize coding conventions for Shariah rules so auditability and readability improve across all AI modules.”	“Embed social-learning features—like peer endorsements of AI answers—to build community trust in new knowledge.”	“Invest in robust API governance to ensure all AI systems consume the same canonical rule set.”	“Establish branch-level ‘digital champions’ who coach colleagues on AI-assisted Shariah applications.”	“Create an anonymized data-sharing consortium with peer banks to enrich model training on rare Shariah scenarios.”

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