

Cognitive Appraisal as a Central Mechanism in Islamic Ethical Decision Making: Evidence from AI-Enabled Islamic Fintech in Indonesia

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Abstract

Purpose – This study investigates how Islamic skepticism, perceived Islamic value, and experiential quality shape cognitive appraisal, Shariah risk perception, and Islamic ethical intention in AI-enabled Islamic fintech services. The research addresses the growing need to understand ethical decision processes in technology mediated religious environments where algorithmic judgments are increasingly used to signal Shariah compliance.

Design/Methodology/Approach – A quantitative cross-sectional survey was conducted with Muslim users of Islamic fintech platforms in major urban areas of Indonesia. Data were collected from 439 respondents using validated Likert scale items. Structural equation modeling with SmartPLS was employed to evaluate measurement reliability and test direct and mediating relationships.

Findings – The results show that experiential quality and cognitive appraisal are the strongest predictors of Islamic ethical intention. Islamic skepticism reduces cognitive appraisal, while perceived Islamic value and experiential quality enhance it. Cognitive appraisal increases Shariah risk perception and strongly predicts ethical intention. Shariah risk perception negatively influences ethical intention and mediates the effect of cognitive appraisal.

Originality/Value – The study integrates cognitive appraisal theory and Islamic ethical decision-making in the context of AI-enabled fintech. It identifies experiential quality and cognitive appraisal as central mechanisms that explain how users interpret Shariah related cues in automated systems.

Research Limitations/Implications – The cross-sectional design limits causal inference, and the geographic focus may affect generalizability. The findings enrich theoretical models of Islamic ethical intention in digital service settings.

Practical Implications – Fintech providers should enhance experiential quality, increase transparency of Shariah governance, and clarify AI-enabled compliance processes to strengthen user trust and ethical engagement.

Keywords – Islamic Ethical Intention, Cognitive Appraisal, Experiential Quality, Islamic Fintech, Shariah Risk Perception

1. Introduction

The rapid development of Islamic financial technology in Indonesia has transformed the way Muslim consumers evaluate and engage with Shariah compliant products ([Faizi et al.,](#)

Received: 2025-12-03 — Revised: 2025-12-18, 2026-05-19 — Accepted: 2026-07-06

e-ISSN: 3123-769X

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2025). Indonesia, as the world's largest Muslim majority nation, has experienced significant growth in Islamic fintech services, including AI assisted Shariah screening tools, robo-advisory investment platforms, automated zakat calculators, and digital halal verification systems (Trisanty et al., 2024). These innovations promise efficiency and accessibility, yet they also introduce new ethical questions related to the reliability of algorithmic judgment, transparency of Shariah screening processes, and authenticity of Islamic value commitments made by firms.

The rapid integration of artificial intelligence into Islamic fintech services has shifted key Shariah-related judgments from human scholars to algorithmic systems, requiring Muslim consumers to reassess how Shariah compliance is evaluated in digital environments (Faizi et al., 2025). While AI-enabled systems enhance scalability and consistency, they simultaneously introduce ethical uncertainty, as users must determine whether algorithmic decisions genuinely reflect Islamic principles rather than merely symbolic compliance claims.

Decision making in Islamic digital environments does not rely solely on technical functionality (Noor, 2025). Instead, it involves cognitive and moral reasoning shaped by skepticism toward Islamic claims, perceived alignment with Islamic values, experiential quality during platform use, and perceptions of Shariah related risks (Rostiani et al., 2024). Islamic fintech services therefore provide a highly relevant context for examining how consumers interpret, evaluate, and ultimately decide to use digital platforms that claim to operate according to Islamic ethical standards (Maniam, 2024). In this context, Islamic Ethical Intention reflects not only adoption willingness but also consumers' moral commitment to engaging with AI-enabled services perceived as religiously legitimate

Although prior studies have explored consumer adoption of Islamic fintech, much of the existing literature focuses on trust, perceived usefulness, religiosity, and general satisfaction (Alsmadi & Al Omoush, 2025; Maniam, 2024). These studies seldom consider the psychological mechanisms involved in evaluating Shariah authenticity in AI-enabled systems. Furthermore, research has not adequately examined the role of Islamic Skepticism, particularly skepticism directed at algorithmic Shariah claims (Rostiani et al., 2024). This type of skepticism is increasingly relevant in digital environments where companies emphasize Islamic positioning as a branding strategy (Trisanty et al., 2024). As a result, existing models provide limited insight into how Muslim consumers cognitively process and evaluate automated Shariah assurances embedded in fintech platforms.

Another critical gap concerns the limited attention given to cognitive appraisal as a process through which consumers interpret Islamic value signals, digital experiences, and perceived Shariah compliance (Hoseininasab, 2024). Most Islamic marketing studies treat cognitive evaluation as a simple belief structure rather than a dynamic appraisal process (Mohamed & Aziz, 2022). In addition, Shariah Risk Perception remains under examined in the context of AI-enabled fintech despite concerns about algorithmic errors, automated fatwa interpretation, and potential misclassification of financial products (Zafar & Ali, 2025). This omission constrains the theoretical explanation of how ethical uncertainty emerges from technology-mediated religious judgments.

Finally, prior studies rarely integrate both Cognitive Appraisal Theory and Islamic ethical decision frameworks to explain how Muslim consumers form Islamic ethical intention in technology mediated environments (Harun et al., 2019). This combined theoretical approach is essential for understanding the complex ethical reasoning process that occurs when technology and religion intersect. Addressing this gap is particularly important in AI-enabled Islamic fintech, where ethical evaluation depends on users' cognitive interpretation of opaque algorithmic processes (Al-Kandari et al., 2025)

This study offers three major contributions. First, it introduces Islamic Skepticism toward AI-enabled Shariah claims as a determinant of ethical decision making, addressing a rarely

studied dimension of skepticism specific to Islamic digital consumption. Second, it positions Cognitive Appraisal as the central psychological mechanism that links digital experiences, Islamic value perceptions, and Shariah compliance information to ethical behavioral intention. Third, it incorporates Shariah Risk Perception as an additional mediating pathway, highlighting how perceived risks of algorithmic non-compliance influence ethical decision making in Islamic fintech contexts. These contributions present a new integrated model that captures the cognitive, ethical, and technological dynamics shaping Islamic Ethical Intention in Indonesia's emerging AI-enabled fintech landscape.

The conceptual model is grounded in Cognitive Appraisal Theory, which states that individuals form judgments based on evaluations of relevance, moral alignment, and potential outcomes ([Bi et al., 2024](#)). In Islamic fintech settings, consumers rely on these appraisal processes to interpret Islamic authenticity claims, evaluate digital service experiences, and assess the ethical implications of technology mediated interactions ([Maniam, 2024](#)). This theoretical lens enables a clearer explanation of how ethical intention emerges from cognitive evaluation rather than from surface-level trust alone.

Islamic Skepticism is expected to reduce Cognitive Appraisal because it encourages doubt toward Shariah claims and lowers the perceived credibility of AI-enabled compliance systems ([Rostiani et al., 2024](#)). In contrast, Perceived Islamic Value and Islamic Experiential Quality are expected to enhance Cognitive Appraisal, as value congruence and positive digital experiences foster clearer moral interpretation and trust in the platform. Cognitive appraisal serves as the central process influencing both Shariah risk perception and Islamic ethical intention ([Hamzah et al., 2025](#)). When appraisal increases clarity and trust, ethical intention rises, but when it highlights potential non-compliance in automated systems, ethical intention may decline.

This study proposes an integrated framework to explain how Muslim consumers evaluate AI-enabled Shariah-compliant fintech services and form Islamic ethical intention. By connecting cognitive appraisal and Shariah-related risk judgments with key antecedent constructs, the research seeks to advance theoretical understanding and support the ethical development of Islamic digital financial platforms.

2. Literature review

This study integrates Cognitive Appraisal Theory and Islamic Ethical Decision-Making Theory. Cognitive Appraisal Theory explains how individuals evaluate stimuli and form judgments about risk and opportunity ([Bi et al., 2024](#)), while Ethical Decision-Making Theory provides the normative content and value priorities that shape moral evaluation and intention in Muslim consumers ([Versteegt et al., 2025](#)). Together these theories explain how value congruence, skepticism, and experiential cues are appraised cognitively and then translated into Shariah risk perceptions and Islamic ethical intention. This integrative perspective allows cognitive appraisal to be positioned as an active psychological mechanism rather than a static belief structure.

2.1. Islamic skepticism has a negative effect on cognitive appraisal.

Islamic skepticism denotes a dispositional or situational tendency among Muslim consumers to doubt marketing claims that invoke religious attributes ([Trisanty et al., 2024](#)). From the cognitive appraisal perspective, skepticism operates as a negative evaluative filter. Consumers with high skepticism allocate more attention to incongruities and source credibility cues, producing more critical primary and secondary appraisals ([da Costa Filho & da Costa Hernandez, 2025](#)). Empirical marketing literature on advertising skepticism shows that distrust toward claims reduces the credibility of messages and leads to less favorable cognitive evaluations ([Taufik et al., 2025](#)).

In the Islamic ethical decision framework, skepticism often arises when firms appear to overclaim religious compliance or engage in Shariah washing. Because Islamic moral norms prize truthfulness and prohibitions on deception, such cues intensify negative appraisal ([Mohamed & Aziz, 2022](#)). Taken together, these theoretical and empirical strands predict that Islamic skepticism will lower the strength and favorability of cognitive appraisal processes applied to marketing stimuli. Skepticism in this context does not necessarily imply heightened evaluative engagement but may instead suppress willingness to cognitively elaborate on Shariah-related cues when their credibility is questioned

H1. Islamic skepticism has a negative effect on cognitive appraisal.

2.2. Perceived Islamic value has a positive effect on cognitive appraisal.

Perceived Islamic value captures the perceived congruence between product/service attributes and Islamic principles (honesty, halal integrity, justice, and maslahah) ([Aji et al., 2021](#); [Suandi et al., 2025](#)). Cognitive Appraisal Theory holds that value congruence facilitates favorable primary appraisals and lowers appraisal uncertainty, producing stronger positive evaluations ([Primadona et al., 2025](#)). Empirical work in halal and Islamic marketing shows that perceived value and value-fit increase trust, reduce cognitive dissonance, and support favorable evaluations that precede decision formation ([Elmahjub, 2023](#); [Noor, 2025](#)).

Islamic ethical decision frameworks add that when consumers perceive strong Islamic value fit, moral reasoning and spiritual comfort amplify positive appraisal and pro-ethical intentions ([Noor, 2025](#)). Therefore, perceived Islamic value is expected to strengthen cognitive appraisal.

H2. Perceived Islamic value has a positive effect on cognitive appraisal

2.3. Experiential quality has a positive effect on cognitive appraisal.

Experiential quality refers to the perceived excellence of service encounters, the servicescape, and interactional elements that constitute a consumer's lived experience ([Aakko & Niinimäki, 2022](#)). Appraisal theory indicates that concrete experiential cues (e.g., hospitality, empathy, responsiveness) contribute to favorable implication and coping-potential appraisals, signaling reliability and normative fit ([Sthapit et al., 2023](#)).

In Islamic contexts, experiential quality that reflects adab, ihsan, and transparent halal practices reinforces moral salience and engenders positive cognitive evaluations ([Zada et al., 2024](#); [Faizi et al., 2025](#)). Recent empirical reviews show experiential quality is a key antecedent of perceived value and trust in Muslim consumer settings ([Nguyen et al., 2025](#)). Accordingly, higher experiential quality will be associated with stronger, more positive cognitive appraisal.

H3. Experiential quality has a positive effect on cognitive appraisal.

2.4. Cognitive appraisal has a positive effect on Shariah risk perception.

Cognitive appraisal is the evaluative process by which individuals interpret stimuli for relevance, implications, and normative significance ([Mokhtari Khatunabad et al., 2025](#)). A more active, thorough appraisal increases sensitivity to potential inconsistencies or warning signals about Shariah noncompliance. Thus, stronger cognitive appraisal can lead consumers to perceive higher Shariah-related risk when any ambiguity or negative cue is present ([Faizi et al., 2025](#)).

Islamic ethical theory supports this mechanism: thorough value-based evaluation raises vigilance for unlawful elements and perceived non-compliance, increasing Shariah risk perception ([Alshammari & Al-Mamary, 2025](#); [Han et al., 2024](#)). Accordingly, heightened appraisal reflects greater moral attentiveness rather than avoidance-oriented suspicion.

H4. Cognitive Appraisal has a positive effect on Shariah Risk Perception.

2.5. Cognitive appraisal has a positive effect on Islamic ethical intention.

Cognitive appraisal produces the evaluative judgments that ground intention formation ([Prayag et al., 2022](#)). Favorable appraisals increase perceived appropriateness and anticipated benefits of ethically aligned actions ([Alam et al., 2025](#)). From the Islamic ethical decision perspective, cognitive processes that interpret an option as consistent with Shariah and moral goods strengthen the intention to act ethically ([Hoseininasab, 2024](#)).

Cognitive appraisal may simultaneously heighten Shariah risk perception and strengthen ethical intention ([Anwar et al., 2025](#)). While increased appraisal can reveal potential non-compliance risks, it also enhances moral awareness and ethical engagement, motivating consumers to form stronger ethical intentions rather than disengage from Islamic fintech services.

Several empirical studies in Islamic marketing and ethics show that reasoned moral evaluation (appraisal) predicts ethical behavioral intentions, particularly when religiosity and value congruence are salient ([Alshehri et al., 2021](#); [Alqhaiwi et al., 2024](#)). Fintech providers should enhance experiential quality, increase transparency of Shariah governance, and clarify AI based compliance processes to strengthen user trust and ethical engagement. Therefore, stronger cognitive appraisal should predict higher Islamic ethical intention.

H5. Cognitive Appraisal has a positive effect on Islamic Ethical Intention.

2.6. Shariah risk perception has a negative effect on Islamic ethical intention.

Risk perception literature indicates that perceived risk typically reduces behavioral intentions because potential harm or moral conflict creates avoidance tendencies ([Jones & Menon, 2022](#); [Kannike & Fahm, 2025](#)). In an Islamic context, Shariah risk perception denotes the perceived likelihood that an action or product violates religious norms; such perception reduces the individual's willingness to form an ethical intention that would associate them with potential ([Mohamed & Aziz, 2022](#)).

Empirical halal/Islamic consumption studies also show perceived Shariah risk undermines purchase or participation intentions ([Ahmed et al., 2022](#)). Accordingly, increased Shariah risk perception will lower Islamic ethical intention.

H6. Shariah risk perception has a negative effect on Islamic ethical intention.

2.7. Cognitive appraisal mediates the effect of Islamic skepticism on shariah risk perception.

Islamic skepticism prompts consumers to scrutinize information more critically, especially when firms claim Shariah compliance ([Talang, 2025](#)). This heightened scrutiny affects the cognitive appraisal process, often making it more cautious and evaluative. Cognitive appraisal theory states that individuals assess potential threats based on perceived credibility and compatibility with personal standards ([Han et al., 2024](#)). When appraisal is shaped by skepticism, consumers are more likely to interpret ambiguous or incomplete information as signs of potential Shariah violation.

Research shows that skepticism heightens risk evaluations, particularly in religious contexts where compliance is essential ([Han et al., 2024](#); [Wardley, 2021](#)). Therefore, Islamic skepticism influences Shariah risk perception through cognitive appraisal, which filters information in a way that amplifies concerns regarding non-compliance.

H7. Cognitive appraisal mediates the effect of Islamic skepticism on Shariah risk perception.

2.8. Cognitive appraisal mediates the effect of perceived Islamic value on Shariah risk perception.

Perceived Islamic value shapes how consumers cognitively assess the moral and religious compatibility of a product ([Khan et al., 2025](#)). When value alignment is high, consumers engage in deeper reflective processes to ensure that the offering meets Islamic criteria.

Cognitive appraisal theory suggests that such reflective evaluation enhances sensitivity toward risks that may contradict personal beliefs or moral expectations ([Zhang et al., 2023](#)).

This heightened sensitivity can increase perceived Shariah risk, especially when consumers become more vigilant about potential inconsistencies or hidden issues. Research highlights that strong religious value orientation makes consumers more cautious and more attentive to compliance concerns ([Sari et al., 2024](#)). Therefore, perceived Islamic value influences Shariah risk perception indirectly through the appraisal mechanisms that guide evaluative reasoning.

H₈. Cognitive appraisal mediates the effect of perceived Islamic value on Shariah risk perception.

2.9. Cognitive appraisal mediates the effect of experiential quality on Shariah risk perception

Experiential quality contributes to the way consumers appraise the integrity and ethical transparency of a service environment ([Saut & Bie, 2024](#)). When experiential quality reflects Islamic ethical attributes, consumers engage in deeper normative evaluation to ensure that the experience adheres to religious expectations ([Abdelghani et al., 2025](#)). Cognitive appraisal theory explains that positive experiences can activate stronger evaluative processes, which in turn sharpen awareness of potential risks ([Conte et al., 2023](#)).

In Islamic contexts, consumers become more attentive to Shariah details when they encounter ethically resonant experiences. However, stronger appraisal may also increase perceived risk if consumers detect ambiguity or inconsistency in compliance cues. Existing studies note that ethical or religiously meaningful experiences can raise expectations and heighten sensitivity to risk ([Conte et al., 2023](#); [Faizi et al., 2025](#)). Thus, experiential quality affects Shariah risk perception through its influence on cognitive appraisal.

H₉. Cognitive appraisal mediates the effect of experiential quality on Shariah risk perception.

2.10. Cognitive appraisal mediates the effect of Islamic skepticism on Islamic ethical intention.

Islamic skepticism reflects a consumer's tendency to doubt the authenticity, credibility, and moral sincerity of Islamic marketing claims ([Sakinah & Gayatri, 2024](#)). When skepticism is high, consumers become more vigilant in interpreting religious messages, leading them to question the credibility of information presented by firms. Cognitive appraisal theory explains that individuals evaluate stimuli based on perceived relevance, potential benefits, and consistency with internal beliefs ([Kim & Chon, 2025](#)). In the context of Islamic consumption, skepticism shapes the appraisal process by increasing the likelihood that consumers will evaluate information defensively and with lower trust.

A more defensive appraisal reduces moral clarity and weakens the cognitive pathway that leads individuals to form intentions rooted in Islamic ethics. Prior research indicates that when appraisal processes reflect distrust or uncertainty, consumers tend to avoid ethical commitments and instead adopt a more cautious decision-making stance ([Kim & Chon, 2025](#); [Usmonov, 2025](#)). Therefore, cognitive appraisal represents the mental mechanism through which Islamic skepticism diminishes Islamic ethical intention.

H₁₀. Cognitive Appraisal mediates the effect of Islamic Skepticism on Islamic Ethical Intention

2.11. Cognitive appraisal mediates the effect of perceived Islamic value on Islamic ethical intention.

Perceived Islamic value refers to the degree to which consumers believe that a product or service aligns with Islamic teachings and principles. When consumers perceive strong value

congruence, they experience a sense of compatibility between their religious identity and the offering. This perception enhances cognitive appraisal by facilitating positive evaluations of moral appropriateness, credibility, and religious alignment. According to cognitive appraisal theory, such alignment contributes to favorable judgments that support ethical behavior ([Li et al., 2025](#))

In Islamic marketing contexts, the perception of value congruence encourages consumers to evaluate products through a moral lens, increasing the likelihood that they will form ethical intentions ([Alsaad et al., 2021](#)). Studies demonstrate that Islamic value alignment enhances trust, spiritual satisfaction, and moral reasoning, all of which strengthen ethical decision intention ([Hoseininasab, 2024](#)). Thus, cognitive appraisal functions as the cognitive route through which perceived Islamic value influences Islamic ethical intention.

H11. Cognitive appraisal mediates the effect of perceived Islamic value on Islamic ethical intention.

2.12. Cognitive appraisal mediates the effect of experiential quality on Islamic ethical intention.

Experiential quality encompasses consumers' perceptions of service excellence, sincerity, hospitality, transparency, and emotional engagement during interactions ([Tabaeeian et al., 2023](#)). Experiences reflecting Islamic ethics, such as honesty, compassion, and fairness, shape the appraisal process by reinforcing positive evaluations of the firm's moral integrity. Cognitive appraisal theory asserts that emotionally and morally congruent experiences influence evaluative judgments, which then guide behavioral intention ([Sthapit, 2023](#)).

In Islamic consumption settings, high experiential quality signals respect, trustworthiness, and adherence to ethical values, all of which promote positive cognitive appraisal. Prior research indicates that positive experiential cues heighten consumers' moral evaluations and strengthen their intention to act in accordance with Islamic ethics ([Taufik et al., 2025](#)). As a result, experiential quality affects Islamic ethical intention indirectly through its influence on cognitive appraisal.

H12. Cognitive appraisal mediates the effect of experiential quality on Islamic ethical intention.

2.13. Shariah risk perception mediates the effect of cognitive appraisal on Islamic ethical intention.

Cognitive appraisal shapes how consumers interpret the moral and religious implications of their choices ([Rafidinal et al., 2025](#)). When appraisal yields concern about ambiguity, uncertainty, or potential non-compliance, consumers develop heightened Shariah risk perception. In decision science, risk perception functions as a barrier that reduces the likelihood of forming a strong behavioral intention ([Nazir et al., 2021](#)).

In Islamic ethical decision-making, perceived Shariah risk plays an even more critical role because consumers must avoid doubtful or potentially impermissible actions. Studies show that perceived religious risk suppresses ethical intention by generating fear of engaging in non-compliant behavior ([Usman et al., 2025](#)). Therefore, Shariah risk perception mediates the relationship between cognitive appraisal and Islamic ethical intention, translating evaluative judgments into cautious behavioral outcomes.

H13. Shariah Risk Perception mediates the effect of Cognitive Appraisal on Islamic Ethical Intention.

The conceptual relationships among the variables examined in this study are illustrated in [Figure 1](#). This framework integrates the cognitive appraisal mechanism and Shariah risk perception pathway to explain how Islamic skepticism, perceived Islamic value, and experiential quality shape Islamic ethical intention.

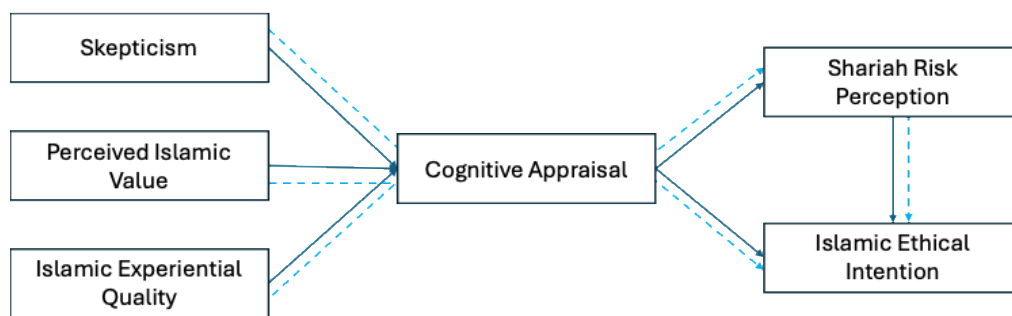


Figure 1. Framework Research

3. Methodology

The study applied a quantitative cross sectional survey design to examine the relationships among skepticism, perceived Islamic value, Islamic experiential quality, cognitive appraisal, Shariah risk perception, and Islamic ethical intention within AI-enabled Shariah compliant fintech platforms in Indonesia. Data were collected online over a four-week period using purposive sampling, targeting Muslim users located in Jakarta, Bogor, Depok, Tangerang, and Bekasi who had experience with Islamic fintech services during the past twelve months. A minimum sample size of 200 respondents was exceeded with 439 participants, all of whom provided informed consent. The questionnaire consisted of twenty-four Likert scale items adapted from established sources, including Amawate and Deb (2021), Abror et al. (2022), Hussein and Hapsari (2021), Pederson (2025), and Yagmur and Aksu (2021). Expert review and a pilot test ensured clarity, content validity, and cultural suitability, while anonymity assurances, randomized item order, and neutral phrasing helped minimize response bias.

Data were analyzed using SmartPLS. The measurement model was evaluated through reliability and validity assessments, including composite reliability, AVE, Fornell Larcker criteria, and HTMT ratios. The structural model was assessed using bootstrapping with five thousand resamples to determine the significance and magnitude of direct and mediating effects. Predictive relevance was examined using Q squared statistics, blindfolding, and PLS Predict (Hair et al., 2021). Demographic and usage data, such as gender, age, education level, and frequency of Islamic fintech use, were also collected to contextualize the respondent profile and to ensure that the sample accurately represented active users of AI-enabled Islamic financial services in the Jabodetabek region.

To assess potential common method bias, a full collinearity variance inflation factor (VIF) test was conducted following the recommendation of Kock (2015). This approach evaluates common method bias by examining whether VIF values exceed the conservative threshold of 3.3. The results show that all inner VIF values range between 1.000 and 1.119, which are well below the recommended threshold. These findings indicate that common method bias is unlikely to be a serious concern in this study.

4. Results

4.1. Validity and reliability

The outer loadings reported in Table 1 indicate the strength of the relationship between each indicator and its corresponding latent construct. During the measurement model evaluation, items SKEP5 and INT1 were removed due to outer loadings below the recommended threshold of 0.70 and their adverse impact on construct reliability. All retained items exhibit outer loadings above the conventional threshold of 0.70, supporting their inclusion in the measurement model. Specifically, the outer loadings for the cognitive

appraisal construct range from 0.758 (COG2) to 0.883 (COG4). The Islamic experiential quality construct shows outer loadings ranging from 0.796 (IEQ4) to 0.885 (IEQ2). The Islamic Ethical Intention construct has outer loadings between 0.781 (INT2) and 0.898 (INT5). The Skepticism construct demonstrates values between 0.874 (SKEP4) and 0.933 (SKEP3). The Shariah risk perception construct shows loadings from 0.766 (SRC1) to 0.915 (SRC3). The perceived Islamic value construct ranges from 0.826 (VAL1) to 0.904 (VAL3). These values collectively indicate that each indicator demonstrates strong and adequate loading on its intended construct, confirming indicator reliability and construct relevance in the structural model.

Table 1. Outer Loading

Code	Items	Outer Loading
Skepticism (Amawate & Deb, 2021)		
SKEP1	I believe that many claims about Shariah compliance made by AI-enabled fintech platforms are not entirely accurate.	0.898
SKEP2	I feel that some statements about Islamic compliance used in digital financial services are intended to influence users rather than provide truthful information.	0.918
SKEP3	I think that firms often exaggerate their claims about AI-enabled Shariah screening, so consumers would be better protected if such claims were more strictly regulated.	0.933
SKEP4	I do not fully trust the Shariah related explanations provided by fintech companies	0.874
Perceived Islamic Value (Abror et al., 2022)		
VAL1	This Islamic fintech platform provides services that genuinely comply with Shariah principles.	0.826
VAL2	I feel that using this fintech platform benefits me because it follows Islamic legal requirements in its financial processes.	0.832
VAL3	I feel confident using this platform because its Shariah compliance is aligned with guidelines issued by recognized Islamic regulatory bodies.	0.904
VAL4	The products offered by this Islamic fintech platform benefit me because they are both competitive and consistent with Islamic rules.	0.886
Islamic Experiential Quality (Hussein & Hapsari, 2021)		
IEQ1	The Islamic fintech platform responds quickly when I need assistance or support.	0.843
IEQ2	The Islamic fintech platform provides interactions that feel polite, respectful, and aligned with Islamic values.	0.885
IEQ3	The Islamic fintech platform delivers services promptly and efficiently whenever I request them.	0.856
IEQ4	The Islamic fintech platform provides clear and helpful information about its processes, including Shariah related procedures.	0.796
Cognitive Appraisal (Pederson, 2025)		
COG1	The Shariah information on this Islamic fintech platform helps me make ethical financial decisions.	0.840
COG2	The platform's Shariah features encourage me to think carefully about decisions that align with Islamic values.	0.758
COG3	Unclear Shariah information on this platform makes it difficult to make confident ethical decisions.	0.857
COG4	Uncertainty about the platform's AI-based Shariah screening limits my ability to act according to Islamic values.	0.883
Shariah Risk Perception (Yagmur & Aksu, 2021)		
SRC1	The thought of using an AI-based Islamic fintech platform makes me feel anxious if I am not fully sure about its Shariah compliance.	0.766
SRC2	I experience tension when I think about the possibility that AI algorithms might misclassify a financial product as Shariah compliant.	0.882
SRC3	I worry about the integrity of the AI systems used to determine Shariah compliance on this fintech platform.	0.915
SRC4	I am concerned that the requirements for Shariah compliance are not fully fulfilled by the platform's automated systems.	0.868
Islamic Ethical Intention (Amawate & Deb, 2021)		

Code	Items	Outer Loading
INT2	I am willing to encourage others to choose Islamic fintech platforms that follow reliable and transparent Shariah principles.	0.781
INT3	I intend to avoid digital financial services that show ambiguity or doubt regarding Shariah compliance.	0.868
INT4	I am eager to learn more about Islamic fintech products to ensure my financial decisions remain ethically aligned with Islamic teachings.	0.877
INT5	I am willing to pay more or invest extra effort to use fintech services that genuinely adhere to Shariah requirements.	0.898

Source: Processed Data (2025)

Table 2 presents the reliability and validity statistics for each construct together with the heterotrait monotrait ratio matrix that is used to assess discriminant validity. Cronbach's alpha values range from 0.856 for Cognitive Appraisal to 0.928 for Skepticism, and all values exceed the recommended minimum level of 0.70. These results indicate strong internal consistency across all constructs. Composite reliability values fall between 0.902 and 0.948, which also surpass the recommended threshold of 0.70. This confirms that each construct demonstrates satisfactory reliability within the measurement model.

Convergent validity is supported by the average variance extracted values that range from 0.698 for Cognitive Appraisal to 0.821 for Skepticism. All AVE values exceed the minimum requirement of 0.50, which affirms that the indicators consistently explain a substantial portion of the variance in their respective constructs (Hair et al., 2021).

The heterotrait–monotrait (HTMT) ratio between Islamic experiential quality and Shariah risk perception is 0.879, which marginally exceeds the conservative threshold of 0.85. This value is explicitly acknowledged as a potential concern for discriminant validity. However, from a theoretical perspective, the two constructs capture conceptually distinct domains. Islamic experiential quality reflects users' perceptions of service interaction, responsiveness, transparency, and ethical ambiance, whereas Shariah risk perception represents anticipatory concern regarding potential non-compliance and moral uncertainty. In AI-enabled Islamic fintech contexts, positive experiential cues may activate higher moral expectations, which can heighten attentiveness to Shariah-related issues without implying conceptual redundancy. Therefore, the elevated HTMT value is more plausibly attributed to contextual proximity rather than overlap in construct meaning (Voorhees et al., 2016). Moreover, all other HTMT values remain below the recommended thresholds, supporting the overall discriminant validity of the measurement model.

Collectively, the findings confirm that the measurement model satisfies the criteria for reliability, convergent validity, and discriminant validity, thereby demonstrating adequate psychometric quality.

Table 2. PLS Algorithm

Constructs	Reliability and Validity			HTMT Results				
	α	CR	AVE	COG	INT	IEQ	VAL	SRC
COG	0.856	0.902	0.698					
INT	0.879	0.917	0.735	0.673				
IEQ	0.868	0.909	0.715	0.309	0.170			
VAL	0.886	0.921	0.744	0.191	0.317	0.109		
SRC	0.882	0.919	0.739	0.227	0.236	0.879	0.197	
SKEP	0.928	0.948	0.821	0.182	0.309	0.280	0.236	0.461

Source: Processed Data (2025)

The inner VIF values, which range from 1.000 to 1.119, are well below the threshold of 3.3 or even the stricter threshold of 2.5. These values indicate the absence of problematic multicollinearity among the predictor constructs. The SRMR value for the saturated model is

0.079, which is below the 0.08 benchmark and therefore suggests acceptable overall model fit. In contrast, the estimated model shows an SRMR of 0.176, which exceeds this benchmark and implies poorer fit along with the possibility of model misspecification or omitted structural paths (Hair et al., 2021).

The f square effect sizes show that cognitive appraisal exerts a large effect on Islamic ethical intention, with an f square value of 0.707. Islamic experiential quality, with a value of 0.121, and Shariah risk perception, with a value of 0.128, demonstrate small to medium effects on cognitive appraisal and Islamic ethical intention. Other f square values, such as 0.052 for the effect of skepticism on cognitive appraisal and 0.041 for the effect of Perceived Islamic Value on Cognitive Appraisal, indicate small or negligible effects.

The R square values reveal that the model explains 14.9 percent of the variance in Cognitive Appraisal, with an adjusted value of 14.3 percent. The model explains 42.7 percent of the variance in Islamic Ethical Intention, with an adjusted value of 42.4 percent, indicating substantial explanatory power. The model explains only 3.9 percent of the variance in Shariah Risk Perception, with an adjusted value of 3.7 percent, which suggests limited predictive relevance for this outcome.

4.2. Hypotheses results

As presented in Table 3, the results indicate that all direct paths in the structural model are statistically significant at the 0.05 level. The relationship between perceived Islamic value and cognitive appraisal is also significant, although with a relatively smaller effect size, as reflected by its p value of 0.016. Islamic skepticism demonstrates a significant negative influence on cognitive appraisal, with a standardized coefficient of $\beta = 0.222$ and a p value below 0.001, indicating that higher skepticism is associated with lower levels of cognitive appraisal. Perceived Islamic value contributes a modest but meaningful positive effect on cognitive appraisal, with a coefficient of $\beta = 0.118$ and a p value of 0.016. Islamic experiential quality emerges as the strongest positive predictor of cognitive appraisal, with a coefficient of $\beta = 0.331$ and a p value below 0.001.

The results further show that cognitive appraisal plays a key role in the model by significantly predicting both Shariah risk perception and Islamic ethical intention. Its effect on Shariah Risk Perception is positive and statistically significant, with a coefficient of $\beta = 0.198$ and a p value of 0.001. Its influence on Islamic ethical intention is even more substantial, with a coefficient of $\beta = 0.649$ and a p value below 0.001, representing the strongest path in the structural model. In addition, Shariah risk perception exerts a significant negative effect on Islamic ethical intention, supported by a coefficient of $\beta = 0.276$ and a p value below 0.001. All t values exceed the critical threshold of 1.96, confirming the statistical significance of each estimated relationship (Hair et al., 2021).

Table 3. Direct Effects

Path Coefficients	(O)	(M)	(STDEV)	T Statistics	P Values	95% CI (Lower, Upper)
SKEP → COG	-0.222	-0.223	0.042	5.275	0.000	[-0.304, -0.140]
VAL → COG	0.118	0.122	0.049	2.410	0.016	[0.022, 0.214]
IEQ → COG	0.331	0.336	0.045	7.444	0.000	[0.243, 0.419]
COG → SRC	0.198	0.202	0.059	3.384	0.001	[0.082, 0.314]
COG → INT	0.649	0.652	0.037	17.748	0.000	[0.576, 0.722]
SRC → INT	-0.276	-0.277	0.036	7.686	0.000	[-0.347, -0.205]

Source: Processed Data (2025)

Table 4 presents the indirect effect estimates for the mediation paths tested in the structural model. The results show that several mediation relationships are statistically significant. Islamic skepticism demonstrates a significant indirect effect on Shariah risk perception through cognitive appraisal, with an indirect coefficient of 0.044 and a p value of

0.002, indicating that cognitive appraisal serves as a meaningful mediating mechanism linking skepticism to heightened risk perceptions. Islamic experiential quality also exhibits a significant indirect effect on Shariah risk perception through cognitive appraisal. This effect, reflected by a coefficient of 0.066 and a p value of 0.013, suggests that higher experiential quality enhances cognitive appraisal, which subsequently increases perceptions of Shariah-related risk. In contrast, the indirect effect of perceived Islamic value on Shariah risk perception via cognitive appraisal is not statistically significant, as indicated by its p value of 0.061, although the direction of the relationship remains positive.

A different pattern emerges when examining the indirect effects on Islamic ethical intention. Cognitive appraisal significantly mediates the effects of Islamic skepticism, perceived Islamic value, and Islamic experiential quality on Islamic ethical intention. Islamic skepticism shows a significant negative indirect effect on Islamic ethical intention, with a coefficient of 0.144 and a p value below 0.001, indicating that increased skepticism reduces cognitive appraisal, which in turn lowers ethical intention. Perceived Islamic value demonstrates a significant positive indirect effect on ethical intention, supported by a coefficient of 0.077 and a p value of 0.018. Islamic Experiential Quality presents the strongest indirect effect among these relationships, with an estimate of 0.215 and a p value below 0.001, highlighting the important role of experiential quality in shaping ethical behavioral intentions through enhanced cognitive appraisal.

Finally, the results indicate that Shariah risk perception significantly mediates the relationship between cognitive appraisal and Islamic ethical intention. This is evidenced by an indirect coefficient of 0.055 and a p value below 0.001, suggesting that higher cognitive appraisal influences ethical intention not only directly but also indirectly through reduced perceptions of Shariah-related risk. Collectively, these findings underscore the central mediating role of cognitive appraisal within the proposed model and highlight the significance of Shariah risk perception as an additional mediating pathway in shaping Islamic ethical decision intentions.

Table 4. Indirect Effects

Path Coefficients	(O)	(M)	STDEV	T Statistics	P Values	95% CI (Lower, Upper)
SKEP → COG → SRC	-0.044	-0.045	0.014	3.078	0.002	[-0.071, -0.017]
VAL → COG → SRC	0.024	0.024	0.013	1.879	0.061	[-0.001, 0.049]
IEQ → COG → SRC	0.066	0.070	0.026	2.495	0.013	[0.015, 0.117]
SKEP → COG → INT	-0.144	-0.146	0.030	4.851	0.000	[-0.203, -0.085]
VAL → COG → INT	0.077	0.080	0.032	2.378	0.018	[0.014, 0.140]
IEQ → COG → INT	0.215	0.219	0.034	6.290	0.000	[0.148, 0.282]
COG → SRC → INT	-0.055	-0.055	0.015	3.543	0.000	[-0.084, -0.026]

Source: Processed Data (2025)

[Table 5](#) reports the results of the blindfolding procedure and PLS Predict analysis, both of which assess the predictive relevance of the structural model. The blindfolding Q^2 values indicate that all three endogenous constructs demonstrate positive predictive relevance, as each Q^2 value is greater than zero ([Shmueli et al., 2019](#)). Cognitive appraisal achieves a Q^2 value of 0.100, indicating small but meaningful predictive relevance. Islamic ethical intention shows a stronger predictive level with a Q^2 value of 0.308, suggesting moderate predictive accuracy. Shariah risk perception records a Q^2 value of 0.029, indicating very weak yet still positive predictive relevance.

The PLS Predict results complement these findings. The RMSE and MAE values for Cognitive Appraisal, Islamic Ethical Intention, and Shariah Risk Perception suggest acceptable predictive error levels for the model. The Q^2_{predict} values, which represent case-wise cross-validated predictive performance, are positive for all three constructs, further supporting predictive capability. Cognitive appraisal displays a Q^2_{predict} value of 0.132,

Islamic ethical intention shows 0.058, and Shariah risk perception registers 0.047. These positive values confirm that the model performs better than a naïve benchmark in predicting new observations.

Overall, the results of the blindfolding and PLS Predict evaluations indicate that the model possesses acceptable predictive relevance, with the strongest predictive performance observed for Islamic Ethical Intention and the weakest for Shariah Risk Perception.

Table 5. Blindfolding and PLS Predict

Constructs	Blindfolding			PLS Predict		
	SSO	SSE	Q ²	RMSE	MAE	Q ² predict
COG	1756.000	1581.088	0.100	0.937	0.739	0.132
INT	1756.000	1214.730	0.308	0.974	0.832	0.058
SRC	1756.000	1705.211	0.029	0.981	0.828	0.047
IEQ	1756.000	1756.000				
VAL	1756.000	1756.000				
SKEP	1756.000	1756.000				

Source: Processed Data (2025)

5. Discussion

This study examined how Islamic skepticism, perceived Islamic value, and Islamic experiential quality shape cognitive appraisal, Shariah risk perception, and ultimately Islamic ethical intention in AI-enabled Islamic fintech platforms. The discussion is structured to align with the hypothesized relationships, while highlighting how the findings reinforce, refine, or challenge existing scholarly perspectives.

The results demonstrate that Islamic skepticism exerts a significant negative effect on cognitive appraisal, confirming H₁. This supports prior findings that skepticism undermines message credibility and reduces constructive cognitive processing ([da Costa Filho & da Costa Hernandez, 2025](#)). In the Islamic context, skepticism towards Shariah compliance claims further weakens evaluative clarity, consistent with Trisanty et al. (2024), who observed that perceived inauthenticity reduces trust in religiously framed offerings. This study strengthens the argument that algorithmic Shariah claims in fintech are especially vulnerable to skepticism, suggesting that technological opacity intensifies cognitive doubt more than traditional service contexts ([Taufik et al., 2025](#)).

Perceived Islamic value shows a modest yet significant positive influence on Cognitive Appraisal, supporting H₂. This finding aligns with Primadona et al. (2025), who argued that value congruence reinforces favorable cognitive evaluations in halal service settings. However, the effect size here is smaller than in prior research, suggesting that users may not rely solely on claimed Islamic principles when evaluating AI-based platforms, as discussed by Elmahjub (2023). Instead, they may require stronger validation or transparent Shariah governance to transform perceived value into deeper cognitive interpretation ([Taufik et al., 2025](#)). Although prior studies highlight a strong influence of Islamic value congruence on cognitive appraisal, our results indicate only a modest effect. This suggests that in AI-driven fintech, Islamic value cues may not be sufficient without transparent evidence of algorithmic Shariah validation. This nuance expands the literature by demonstrating that technological mediation weakens the direct impact of Islamic value congruence on ethical evaluation.

Islamic Experiential Quality emerges as the strongest predictor of cognitive appraisal, confirming H₃. This reinforces studies in halal hospitality demonstrating that Islamic service experiences elevate moral salience and clarity in evaluation Sthapit et al. (2023). In this study, the strength of the effect indicates that users place substantial weight on service responsiveness, clarity of information, and respectful interaction when forming ethical judgments about fintech platforms ([Zada et al., 2024](#)). This extends prior research by showing

that experiential quality remains highly influential even when interactions occur through digital interfaces rather than face to face encounters.

Cognitive appraisal significantly increases Shariah risk perception, consistent with H4. This supports the theoretical view that deeper cognitive processing enhances vigilance toward potential inconsistencies or violations ([Mokhtari Khatunabad et al., 2025](#)). However, the effect size in this study is small, suggesting that although appraisal increases awareness of risk, users may still struggle to fully assess compliance issues, as found by Alshammari and Al-Mamary ([2025](#)). This contributes to emerging discussions about algorithmic transparency, showing that risk concerns persist because users cannot easily validate AI decisions in fintech environments. This unexpectedly small effect suggests that users may lack the knowledge or transparency required to meaningfully evaluate Shariah risks in AI-based fintech systems.

Cognitive appraisal shows a strong direct influence on Islamic ethical intention, supporting H5. This aligns with ethical decision-making theory, which posits that intention is shaped by moral reasoning clarity and evaluative confidence ([Alam et al., 2025](#)). The strength of this effect aligns with Ahmed et al ([2022](#)), who indicates that cognitive evaluation plays a crucial role in shaping ethical behavior in technology mediated religious contexts. This deepens the theoretical understanding of cognitive appraisal by demonstrating its centrality in contexts where both technical and religious judgments are required.

Shariah risk Perception exerts a significant negative effect on Islamic ethical intention, supporting H6. This mirrors prior findings showing that perceived religious risk strongly discourages ethical or compliant behavior ([Jones & Menon, 2022](#)). The negative coefficient indicates that concerns about AI systems misclassifying products as Shariah compliant meaningfully reduce the willingness to engage ethically ([Kannike & Fahm, 2025](#)). This highlights a unique vulnerability in AI-enabled Islamic fintech: algorithmic uncertainty does not merely reduce trust but also weakens ethical commitment.

The mediation results further enrich the discussion. Cognitive appraisal significantly mediates the relationship between Islamic skepticism and Shariah risk perception, supporting H7. However, unlike prior studies suggesting that skepticism may heighten risk sensitivity when religious claims are difficult to verify ([Han et al., 2024](#)), the present findings indicate that skepticism reduces Shariah risk perception through weakened cognitive appraisal. When skepticism toward AI-enabled Shariah claims leads users to disengage cognitively or dismiss compliance information, the evaluative scrutiny required to detect potential Shariah-related risks diminishes. In this sense, cognitive appraisal functions as an interpretive mechanism that attenuates, rather than amplifies, perceived risk in ambiguous AI contexts ([Wardley, 2021](#)).

The indirect effect of perceived value on risk perception through cognitive appraisal is not significant, offering partial support for H8. This diverges from earlier studies where Islamic value alignment increased risk vigilance ([Zhang et al., 2023](#)). This contrast suggests that in AI-enabled fintech, Islamic value cues may not effectively heighten risk awareness unless accompanied by strong cognitive clarity or detailed Shariah explanations ([Noor, 2025; Sari et al., 2024](#)). This provides a novel insight into how digital environments weaken the traditional influence of Islamic value signals.

Conversely, cognitive appraisal significantly mediates the effect of Islamic experiential quality on Shariah risk perception, supporting H9. This aligns with Conte et al. ([2023](#)) who found that high quality experiences heighten expectations and increase sensitivity to inconsistencies. The result suggests that positive digital experiences encourage users to evaluate Shariah information more critically, potentially magnifying risk concerns when transparency is insufficient ([Faizi et al., 2025](#)). Although experiential quality is typically associated with reduced risk perceptions, in Islamic fintech the opposite may occur. Positive experiences heighten moral expectations, leading users to be more vigilant toward subtle Shariah inconsistencies.

Cognitive appraisal significantly mediates the effect of Islamic skepticism on Islamic ethical intention, supporting H₁₀. This aligns with Kim and Chon (2025), demonstrating that skepticism suppresses ethical behavior by reducing cognitive clarity. This study adds to this understanding by showing that when skepticism targets Shariah claims, its impact on ethical intention is even stronger due to uncertainty in automated reasoning (Usmonov, 2025).

Cognitive Appraisal also mediates the influence of Perceived Islamic Value on Islamic Ethical Intention, supporting H₁₁. This supports Hoseininasab (2024), who argued that value congruence enhances ethical behavior through deeper moral reasoning. Although the effect is smaller than expected, it demonstrates that value alignment still contributes to ethical intention once transformed into cognitive clarity.

Similarly, cognitive appraisal mediates the effect of Islamic experiential quality on Islamic ethical intention, supporting H₁₂. This reinforces findings from Hoseininasab (2024), showing that meaningful service experiences elevate moral evaluation and ethical behavior. The strong mediation effect observed in this study highlights that experiential quality is not only a technical factor but also a moral catalyst in Islamic fintech environments (Nguyen et al., 2025).

Finally, Shariah risk perception significantly mediates the relationship between cognitive appraisal and Islamic ethical intention, supporting H₁₃. This aligns with Zhang et al. (2022), reinforcing that perceived risk weakens behavioral commitment. In the Islamic context, this mediation emphasizes that ethical decisions are shaped simultaneously by cognitive clarity and religious caution (Ahmed et al., 2022), particularly when interacting with automated systems that may lack visible Shariah assurance. Although cognitive appraisal directly enhances ethical intention, its indirect pathway through Shariah risk perception slightly suppresses this positive influence, revealing a dual evaluative mechanism.

These findings position Islamic experiential quality and cognitive appraisal as the two central drivers shaping ethical decision making in AI-enabled Islamic fintech. The study contributes to the literature by demonstrating that digital experiential cues have strong moral implications, and by highlighting the complex role of cognitive and risk-based judgments in technology mediated religious environments. This integrated model advances theoretical understanding in Islamic marketing, ethical decision making, and AI mediated services, offering a framework that aligns technological credibility, experiential quality, and religious values within a unified ethical pathway.

6. Conclusions and future research

This study advances Islamic ethical decision-making theory by formalizing cognitive appraisal as the central mechanism that integrates experiential, skeptical, and value-based inputs into ethical intention formation, resolving prior fragmentation in static belief models. It extends Cognitive Appraisal Theory by demonstrating its dual role. It heightens Shariah risk perception (moral vigilance) while strengthening ethical intention (moral engagement), thereby nuancing its application in algorithmic religious contexts (Conte et al., 2023). Finally, it repositions Islamic skepticism not as disengagement but as a context-specific antecedent that suppresses appraisal, offering a novel theoretical pathway absent in Transaction Cost and ethical adoption literature.

The study offers practical implications for Islamic fintech firms seeking to cultivate strong ethical intention among Muslim users. Enhancing experiential quality through responsive service, transparent communication, and respectful interaction can stimulate deeper and more favorable cognitive appraisal. Increasing the visibility of Shariah governance, clarifying algorithmic decision processes, and communicating compliance validation procedures may further reduce skepticism and mitigate perceived Shariah risk. Practitioners should recognize that Islamic value cues alone are insufficient in AI contexts.

Users require evidence-based explanations of how automated systems process Shariah criteria, especially when decisions are algorithmic rather than human driven. Strengthening these elements can improve evaluative confidence and foster long-term ethical engagement in Islamic fintech ecosystems.

Several limitations should be acknowledged. The study employs a cross-sectional design, which limits the ability to infer temporal dynamics in cognitive appraisal or changes in skepticism as users gain experience with AI-enabled platforms. The sample is concentrated in urban Indonesian settings and may not reflect users in rural regions or in other Muslim-majority countries with different regulatory environments. The model explains limited variance in Shariah risk perception, suggesting that other factors such as literacy in Islamic finance, trust in regulatory authorities, or algorithmic transparency cues may also play influential roles. These limitations provide opportunities to refine and expand the model in future studies.

Future research can build on this work by employing longitudinal or experimental designs to examine how cognitive appraisal evolves as users learn more about AI-enabled Shariah processes. Comparative studies across countries or types of fintech services may clarify contextual differences in skepticism and risk evaluation. Future research may also incorporate constructs such as perceived algorithmic transparency, Shariah governance quality, religious coping, or technological trust to enhance explanatory depth. As AI continues to shape Islamic consumption environments, a deeper understanding of how Muslims interpret automated religious judgments will remain essential for developing ethical, trustworthy, and user-centered Islamic fintech solutions.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Acknowledgement

The authors would like to express their sincere appreciation to the editor and anonymous reviewers for their valuable comments, constructive feedback, and helpful suggestions. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This manuscript does not draw from any previously published work, including conference papers or doctoral dissertations, and represents original research.

Ethical Statement

The authors confirm that they have read and understood the Ethical Guidelines for publication and have complied with all relevant ethical standards in publishing. This manuscript is original, has not been published previously, and is not under consideration for publication elsewhere. The authors also disclose that AI-assisted technologies were used solely to improve the clarity and readability of the language and did not replace any core scholarly tasks such as data analysis, interpretation, or conclusion development.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

AI Assistance Statement

The authors confirm that no generative AI or automated tools were used in the conceptualization, data collection, or analysis of this study. ChatGPT was used exclusively for language refinement, and all intellectual content was generated, reviewed, and verified by the authors.

Appendix

None.