



Entrepreneurial Leadership and Technology Adoption: The Roles of Islamic Work Ethic and Theological Trust

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Article Info

Article history:

Received Mar 14, 2026

Revised Apr 29, 2026

Accepted May 19, 2026

Online First Jun 11, 2026

Keywords:

Entrepreneurial Leadership

Islamic Higher Education

Islamic Work Ethic

Technology Adoption

Theological Trust

ABSTRACT

Purpose of the study: This study examines the determinants of artificial intelligence and learning management system adoption among lecturers and students in Islamic Educational Management programmes at Indonesian Islamic higher education institutions, with Islamic Work Ethic and Theological Trust positioned as direct predictors of behavioural intention.

Methodology: A quantitative cross-sectional survey was administered to 385 respondents drawn from twelve Islamic higher education institutions across five Indonesian regions. Data were analysed using Partial Least Squares Structural Equation Modelling in SmartPLS 4.0, and a Multi-Group Analysis compared lecturers and students after a Measurement Invariance of Composite Models procedure.

Main Findings: Performance Expectancy ($\beta = 0.287$), Islamic Work Ethic ($\beta = 0.224$), Social Influence ($\beta = 0.198$), and Theological Trust ($\beta = 0.176$) significantly predicted Behavioural Intention, explaining 61.3 percent of its variance. Effort Expectancy was non-significant. Behavioural Intention ($\beta = 0.418$) and Facilitating Conditions ($\beta = 0.312$) jointly predicted Use Behaviour, explaining 48.9 percent of its variance. The Multi-Group Analysis revealed stronger Performance Expectancy effects among lecturers and stronger Social Influence effects among students.

Novelty/Originality of this study: This study provides empirical evidence that Islamic Work Ethic functions as a direct predictor rather than a moderator of technology adoption intention in Indonesian Islamic higher education, and it introduces Theological Trust as a construct that captures user concerns about the doctrinal accuracy of artificial intelligence outputs in Islamic content. These extensions are interpreted through entrepreneurial leadership as a guiding lens that links innovation, stakeholder mobilization, and risk assessment in faith-based educational institutions.

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1. INTRODUCTION

The digital transformation of higher education has accelerated following the COVID-19 pandemic and the rapid diffusion of generative artificial intelligence technologies in teaching and learning [1]-[3]. Indonesia, home to the world's largest Muslim population, has a large number of Islamic higher education institutions supervised by the Ministry of Religious Affairs [4]-[6]. These institutions play a strategic role in preparing graduates who later manage madrasah, pesantren, and other Islamic educational organisations across the archipelago. Consequently, the adoption of digital technologies within Islamic Educational Management programmes has significant implications for the development of future faith-based educational leaders [7]-[9]. Recent reports from the Ministry of Religious Affairs suggest that many faculty members have not yet received formal training in artificial intelligence-integrated pedagogy, while learning management system adoption remains relatively limited among Islamic higher education institutions.

Existing scholarship maps technology adoption in higher education mainly through the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology [10], [11]. Performance Expectancy is consistently the strongest predictor of behavioural intention across higher education contexts, including Indonesia [12]-[15]. Within Islamic higher education, prior studies have contextualised these models by treating religion as a moderator rather than a direct driver [16], [17]. However, no published study has targeted Islamic Educational Management programmes specifically, and theological concerns about how reliably artificial intelligence handles Islamic content have not been incorporated into extended acceptance models [18]-[20]. The literature therefore leaves three gaps: an empirical gap on Islamic Educational Management programmes, a theoretical gap on direct value-based predictors, and a contextual gap on Islamic-specific dimensions of trust.

This study addresses these gaps through three novel contributions. First, it positions Islamic Work Ethic as a direct predictor of behavioural intention rather than a moderator of conventional acceptance constructs. Second, it introduces Theological Trust as a construct that captures user confidence in the doctrinal accuracy of artificial intelligence outputs in Islamic content. Third, it interprets the resulting structural relationships through an entrepreneurial leadership lens that links innovation, social mobilization, value-driven leadership, risk management, and resource acquisition in faith-based educational institutions [21]-[23]. Together, these contributions extend the Unified Theory of Acceptance and Use of Technology to value-laden educational settings.

The urgency of this research follows from three converging pressures. First, generative artificial intelligence has reached a level of accessibility and capability that makes its integration into Islamic higher education imminent rather than hypothetical. Second, Indonesian regulatory bodies are actively pushing institutional digital transformation under national digitalisation policies [24]-[26], and recent empirical work in the Indonesian context already shows measurable learning gains from carefully designed digital interventions in both general primary literacy and madrasah-based Islamic education [27]-[29]. Third, faculty and students of Islamic Educational Management programmes have begun to encounter situations where artificial intelligence outputs touch directly on Islamic doctrine, creating new forms of trust calibration that the literature has not yet modelled. A theoretically grounded and empirically tested framework is therefore needed before institutional digital transformation outpaces its conceptual scaffolding.

Against this background, the present study pursues four specific objectives. It examines the direct effects of six exogenous constructs on behavioural intention among lecturers and students in Islamic Educational Management programmes. It analyses the influence of behavioural intention and facilitating conditions on actual use behaviour. It tests whether the structural model operates similarly across lecturer and student subgroups using Partial Least Squares Multi-Group Analysis. And it interprets the resulting evidence through entrepreneurial leadership theory to draw practical and policy implications for Islamic higher education.

2. THE COMPREHENSIVE THEORETICAL BASIS

The model proposed here extends the Unified Theory of Acceptance and Use of Technology by introducing two constructs that prior literature has not jointly tested as direct predictors of behavioural intention in Islamic higher education: Islamic Work Ethic and Theological Trust [10], [16], [17]. The model is read through an entrepreneurial leadership lens that connects each construct to a recognised dimension of leader behaviour in faith-based organisations, namely innovativeness, social mobilization, value-driven leadership, opportunity recognition, risk management, and resource acquisition [21], [22], [30], [31]. Six exogenous constructs predict Behavioural Intention, while Facilitating Conditions and Behavioural Intention predict Use Behaviour. Figure 1 displays the model. The eight hypotheses derived from this theoretical synthesis are formally stated in the subsections that follow and consolidated in Table 1 of the Research Method section.

2.1. Performance Expectancy and Behavioural Intention

Performance Expectancy is the degree to which an individual believes that using a system will yield gains in job or study performance [10]. A meta-analysis of thirty acceptance studies confirmed Performance Expectancy

as the strongest predictor of behavioural intention in higher education [15], [32]. From an entrepreneurial leadership perspective, Performance Expectancy operationalises innovativeness, because leaders who anticipate clear performance gains are more willing to champion new tools [21], [22]. Hypothesis 1 (H1) therefore states that Performance Expectancy positively and significantly affects Behavioural Intention to use artificial intelligence and learning management systems among Islamic Educational Management stakeholders.

2.2. Effort Expectancy and Behavioural Intention

Effort Expectancy denotes the perceived ease associated with using a system [10]. Indonesian studies have reported mixed effects, with several registering small or non-significant coefficients [12]-[14]. Effort Expectancy nevertheless retains theoretical relevance, since low-effort interfaces preserve cognitive resources for innovation in resource-constrained Islamic institutions [21], [31]. Hypothesis 2 (H2) therefore states that Effort Expectancy positively and significantly affects Behavioural Intention.

2.3. Social Influence and Behavioural Intention

Social Influence captures the extent to which an individual perceives that important others believe they should use a new system [10]. In Islamic higher education, the strong vertical authority lines from kyai and senior lecturers to students amplify normative pressure beyond what is observed in secular settings [17]. Entrepreneurial leadership theory frames this as social mobilization, where leaders translate collective expectations into coordinated behavioural change [33], [34]. Hypothesis 3 (H3) therefore states that Social Influence positively and significantly affects Behavioural Intention.

2.4. Facilitating Conditions and Use Behaviour

Facilitating Conditions refer to the perceived organisational and technical infrastructure that supports use of a system [10]. Infrastructure unevenness is a documented constraint for Indonesian Islamic higher education institutions. Entrepreneurial leadership designates resource acquisition as the dimension through which leaders convert infrastructure into operational use [35]-[37]. Hypothesis 4 (H4) therefore states that Facilitating Conditions positively and significantly affect Use Behaviour.

2.5. Islamic Work Ethic and Behavioural Intention

Islamic Work Ethic encompasses values such as *itqan* (excellence), *amanah* (trustworthiness), responsibility, cooperation, and the pursuit of *maslahah*, which together orient professional conduct in faith-based organisations [23], [24], [33], [34]. Three theoretical considerations support modelling Islamic Work Ethic as a direct predictor rather than a moderator. First, decisions in faith-based educational settings are shaped not only by utilitarian calculation but also by ethical alignment with religious duty, which makes ethical orientation a substantive antecedent of intention rather than a contextual modifier [38], [39]. Second, prior empirical work has shown that Islamic Work Ethic directly predicts innovative work behaviour through knowledge sharing [40] and that it shapes job satisfaction and organisational commitment via intrinsic motivation [41], establishing precedent for direct value-driven pathways. Third, prior studies that treat Islamic religiosity exclusively as a moderator have produced inconsistent moderation effects, suggesting model misspecification when value-based motivations are the substantive driver of decisions in religiously embedded professional contexts [16], [17]. Entrepreneurial leadership theory captures this through value-driven leadership, in which leaders mobilise followers around shared moral commitments [21]-[23]. Hypothesis 5 (H5) therefore states that Islamic Work Ethic positively and significantly affects Behavioural Intention.

2.6. Theological Trust and Behavioural Intention

Theological Trust is operationalised as user confidence that artificial intelligence outputs will not contradict authoritative Islamic knowledge sources, a concern documented in recent analyses of artificial intelligence reliability for Islamic content [18], [20]. This dimension extends generic technology trust along three lines. First, generic trust addresses system reliability and data privacy, while Theological Trust addresses doctrinal correctness, which becomes salient when generative tools produce religious content. Second, Islamic education stakeholders apply a verification standard rooted in classical Islamic epistemology, in which knowledge claims must be traceable to authoritative sources, so that trust here functions as a doctrinal calibration mechanism rather than an attitude alone [18], [20], [42]. Third, recent calls for culturally responsive artificial intelligence governance in education emphasise that trust constructs must be contextualised to community knowledge systems [40], [41]. From an entrepreneurial leadership perspective, Theological Trust corresponds to the risk management dimension, where leaders weigh innovation against doctrinal and reputational hazards before authorising organisational adoption [21], [31]. Hypothesis 6 (H6) therefore states that Theological Trust positively and significantly affects Behavioural Intention.

2.7. Behavioural Intention and Use Behaviour

The link between intention and behaviour is well established in the Unified Theory and its extensions, with behavioural intention identified as the most proximal predictor of actual technology use [10], [15]. Entrepreneurial leadership theory interprets this link as opportunity exploitation, in which the cognitive commitment formed at the intention stage is converted into operational behaviour [21], [22]. Hypothesis 7 (H7) therefore states that Behavioural Intention positively and significantly affects Use Behaviour.

2.8. Differences between Lecturers and Students

Lecturers function as established entrepreneurial leaders whose pedagogical practices have been shaped by years of teaching, institutional management, and deeper internalisation of Islamic professional ethics [30], [31]. Students function as emerging entrepreneurial leaders with higher baseline technology exposure but less consolidated value structures and limited leadership experience. These positional differences imply that the relative weights of performance, social, ethical, and trust-based predictors of behavioural intention should differ across the two subgroups. Hypothesis 8 (H8) therefore states that the structural model path coefficients differ significantly between lecturer and student subgroups.

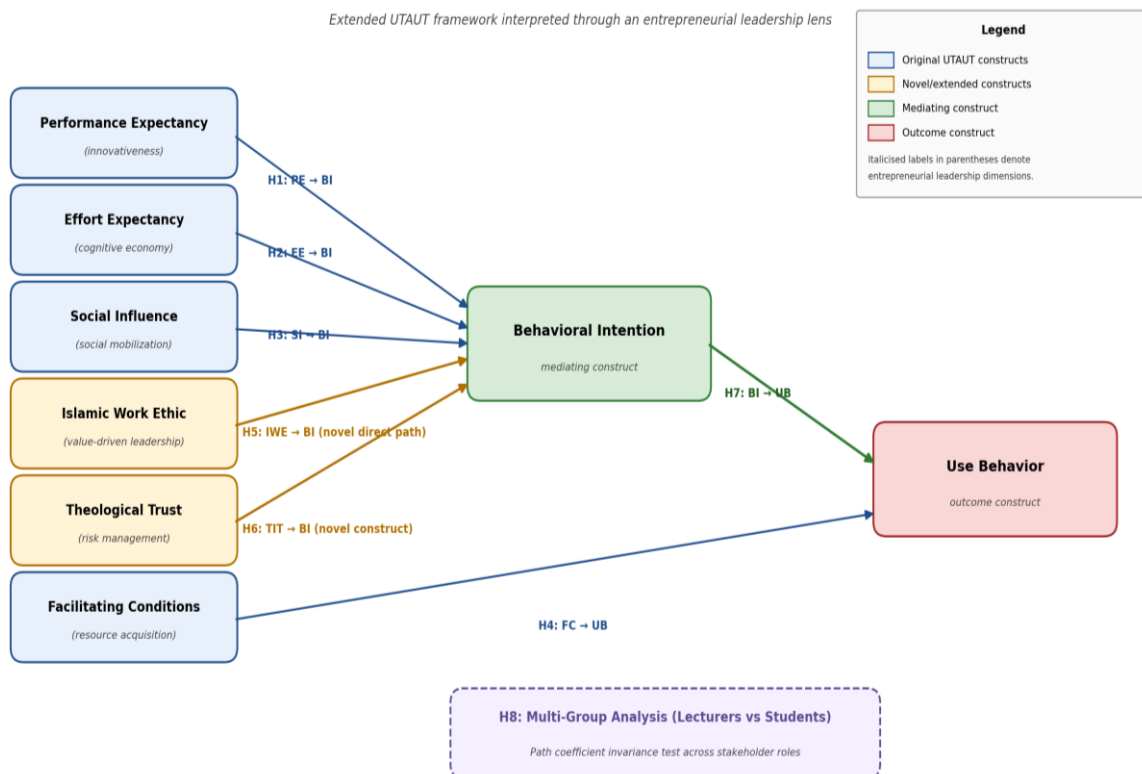


Figure 1. Proposed conceptual model and research hypotheses

3. RESEARCH METHOD

3.1. Research Design

This study employed a quantitative explanatory cross-sectional survey design to test the theorised causal relationships among the extended Unified Theory of Acceptance and Use of Technology constructs, Behavioural Intention, and Use Behaviour. Partial Least Squares Structural Equation Modelling was selected for three principal reasons: the model integrates novel constructs and is exploratory-predictive, the underlying data were not multivariate normal, and the technique handles complex models without strict distributional assumptions [45], [46]. Multi-Group Analysis was added to test path coefficient invariance across lecturer and student subgroups.

The eight hypotheses tested in this study are summarised in Table 1. Hypotheses H1 through H7 specify directional structural paths within the extended Unified Theory model, while H8 specifies the moderating role of stakeholder group through Multi-Group Analysis. Together, the hypotheses operationalise the theoretical model presented in Section 2 and provide the testable propositions evaluated through Partial Least Squares Structural Equation Modelling.

Table 1. Research Hypotheses

H	Path	Hypothesis Statement
H1	PE → BI	Performance Expectancy positively affects Behavioural Intention to use artificial intelligence and learning management systems.
H2	EE → BI	Effort Expectancy positively affects Behavioural Intention.
H3	SI → BI	Social Influence positively affects Behavioural Intention.
H4	FC → UB	Facilitating Conditions positively affect Use Behaviour.
H5	IWE → BI	Islamic Work Ethic positively affects Behavioural Intention.
H6	TIT → BI	Theological Trust positively affects Behavioural Intention.
H7	BI → UB	Behavioural Intention positively affects Use Behaviour.
H8	MGA	Path coefficients differ significantly between lecturer and student subgroups.

Note: PE = Performance Expectancy; EE = Effort Expectancy; SI = Social Influence; FC = Facilitating Conditions; IWE = Islamic Work Ethic; TIT = Theological Trust; BI = Behavioural Intention; UB = Use Behaviour; MGA = Multi-Group Analysis. Construct labels are spelled out in full throughout the manuscript and abbreviated only in tables and figures.

3.2. Population and Sample

The target population comprised all active lecturers and enrolled students in Islamic Educational Management programmes across Indonesian Islamic higher education institutions. A multistage cluster sampling design was used to obtain cross-regional representativeness while preserving fieldwork feasibility. First, institutions were stratified by type into state Islamic universities, state Islamic institutes, and private Islamic higher education institutions. Second, twelve institutions were purposively selected to obtain coverage across five Indonesian regions, namely Java, Sumatra, Kalimantan, Sulawesi, and Eastern Indonesia. Third, lecturers and students within Islamic Educational Management programmes at the selected institutions were randomly approached for participation.

The selection of the twelve institutions followed four explicit criteria. First, the institution had to hold national accreditation of B or higher to maintain consistent academic standards. Second, the institution had to operate an active Islamic Educational Management undergraduate or graduate programme with at least one enrolled cohort during the data collection period. Third, the institution had to maintain an operational learning management system platform such as Moodle or Edlink with documented use across the preceding twenty-four months. Fourth, the institution had to grant formal departmental permission to disseminate the survey to faculty and students. Together, these criteria ensured methodological homogeneity while preserving institutional diversity.

Three complementary procedures were used to determine the minimum sample size. The ten-times rule yielded a minimum of seventy respondents [45]. The G*Power statistical power analysis with $\alpha = 0.05$, power of 0.80, and a medium effect size returned a minimum of 153 [47]. The inverse square root method returned a minimum of 160 at the same significance level [48]. To accommodate Multi-Group Analysis with adequate subsample sizes, the target was set substantially above these thresholds at 385 respondents [46]. A total of 412 questionnaires were distributed and 385 valid responses were retained for analysis after data screening.

Table 2. Aggregate Sample Distribution by Institutional Type and Region

Stratum	Category	n (%)
Institutional type	State Islamic universities	136 (35.3%)
	State Islamic institutes	129 (33.5%)
	Private Islamic higher education institutions	120 (31.2%)
Geographic region	Java	160 (41.6%)
	Sumatra	86 (22.3%)
	Kalimantan	52 (13.5%)
	Sulawesi	49 (12.7%)
	Eastern Indonesia (Maluku and adjacent areas)	38 (9.9%)
Respondent role	Lecturers	185 (48.1%)
	Students	200 (51.9%)
Total		385 (100.0%)

Three sampling limitations are acknowledged at the outset, in line with reviewer guidance to be explicit about purposive selection. First, the twelve sampled institutions account for approximately one percent of all Indonesian Islamic higher education institutions, and Sumatran institutions are over-represented relative to their national proportion, which limits generalisation to provinces and institutional types outside the operational reach of the research team. Second, institutional-level disaggregated data are not reported because participants were assured of anonymity at the institutional level prior to data collection, in line with the privacy protections required under Indonesia's Personal Data Protection Law (Indonesian Law Number 27 of 2022). Third, multi-stage

purposive selection introduces potential selection bias, since institutions willing to participate may differ systematically in their digital readiness from non-participating institutions.

3.3. Instruments and Measurement

The research instrument was a structured online survey questionnaire measuring eight latent constructs through 32 items rated on a five-point Likert scale anchored by 1 = strongly disagree and 5 = strongly agree. Items for Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions were adapted from the original Unified Theory of Acceptance and Use of Technology scales [10]. Islamic Work Ethic items were adapted from Ali and Al-Owaihian's multi-item scale of Islamic work values [34]. Theological Trust items were adapted from prior analyses of artificial intelligence reliability for Islamic content to capture confidence in the doctrinal accuracy of artificial intelligence outputs [18], [20]. Behavioural Intention and Use Behaviour items were adapted from Venkatesh et al. [49]. Item construction followed the established adaptation procedure of forward and back translation between English and Indonesian by two bilingual researchers, with discrepancies resolved through panel discussion.

Content validity was established through expert review by five academic specialists, comprising two Islamic education scholars, two information systems researchers, and one Partial Least Squares Structural Equation Modelling methodologist. Item-level Content Validity Index values ranged from 0.80 to 1.00, with a scale-level Content Validity Index of 0.92, exceeding the 0.78 threshold recommended for new construct development. A pilot test with 40 Islamic Educational Management respondents external to the main sample confirmed satisfactory internal consistency, with Cronbach's alpha values ranging from 0.79 to 0.91. The pilot also supported legibility, item ordering, and acceptable completion time of approximately twelve to fifteen minutes. Detailed construct mapping is presented in Table 3.

Table 3. Instrument Construct Grid (8 Constructs, 32 Items)

Construct	Items	Sample item	Source	α (pilot)	CVI
Performance Expectancy	4	Using these tools improves my productivity in academic work.	Venkatesh et al. [49]	0.86	0.95
Effort Expectancy	4	Learning to operate these tools is easy for me.	Venkatesh et al. [49]	0.84	0.90
Social Influence	4	People who influence my behaviour think I should use these tools.	Venkatesh et al. [49]	0.81	0.88
Facilitating Conditions	4	I have the resources necessary to use these tools.	Venkatesh et al. [49]	0.79	0.85
Islamic Work Ethic	5	Doing my work with itqan (excellence) is a religious obligation.	Ali and Al-Owaihian [34]	0.91	1.00
Theological Trust	4	I can verify that artificial intelligence outputs on Islamic topics are doctrinally accurate.	Adapted from [18], [20]	0.88	0.95
Behavioural Intention	4	I intend to use these tools regularly in my academic activities.	Venkatesh et al. [49]	0.87	0.93
Use Behaviour	3	I currently use these tools in my academic work.	Venkatesh et al. [49]	0.83	0.90

Note: α = Cronbach's alpha at pilot ($n = 40$); CVI = Content Validity Index. All α values exceed the 0.70 threshold and all CVI values exceed the 0.78 threshold for content validity.

3.4. Data Collection Procedures

Data were collected from September to November 2024 through an online survey administered via Google Forms. The survey link was disseminated through formal coordination with department heads at each of the twelve participating institutions, who forwarded the link through three institutional channels: institutional email distribution lists, official student academic information system announcements, and lecturer professional groups within the institution. Two reminder messages were sent at two-week intervals to maximise response rates. Of the 412 questionnaires distributed, 396 were returned, of which 11 were excluded due to straightlining or extreme response time, leaving 385 valid responses for analysis. Informed electronic consent was obtained from all participants through a mandatory consent statement in the first section of the questionnaire, in line with the Declaration of Helsinki and Indonesia's Personal Data Protection Law of 2022. Participation was voluntary, anonymous, and unincentivised. Three embedded attention-check items, response-time monitoring with a minimum threshold of 240 seconds, and a single-submission per email address restriction were used to protect data quality. Ethical clearance was obtained from the Research Ethics Committee of the lead author's institution prior to data collection.

3.5. Data Analysis

Data were analysed in SmartPLS 4.0 using the two-stage Partial Least Squares Structural Equation Modelling procedure of Hair et al. [46]. Mardia's tests confirmed multivariate non-normality ($p < 0.001$), supporting the choice of this variance-based estimator [46]. The measurement model was assessed through outer loadings, average variance extracted, composite reliability, Cronbach's alpha, the Fornell-Larcker criterion, and the heterotrait-monotrait ratio. The structural model was assessed through collinearity diagnostics, R-squared, effect size, and predictive relevance. Path coefficient significance was tested through bias-corrected and accelerated bootstrapping with 5,000 subsamples. The Multi-Group Analysis was preceded by the Measurement Invariance of Composite Models procedure of Henseler et al. [50] to establish measurement invariance across lecturer and student subgroups.

4. RESULTS AND DISCUSSION

Subsection 4.1 reports respondent demographics. Subsection 4.2 reports descriptive statistics. Subsection 4.3 documents measurement model assessment. Subsection 4.4 reports the structural model results and the synthesis of key findings. Subsection 4.5 presents the Multi-Group Analysis comparing lecturers and students. Subsection 4.6 reports common method bias and robustness checks.

4.1. Respondent Demographics

Of the 385 valid respondents, 185 (48.1%) were lecturers and 200 (51.9%) were students. Male respondents constituted 52.7% ($n = 203$) and female respondents 47.3% ($n = 182$). The largest age segment was 25 to 35 years (37.9%), followed by under 25 (29.6%), 36 to 45 years (20.3%), and over 45 (12.2%). Institutional distribution was 35.3% state Islamic universities, 33.5% state Islamic institutes, and 31.2% private Islamic higher education institutions. Geographic distribution covered Java (41.6%), Sumatra (22.3%), Kalimantan (13.5%), Sulawesi (12.7%), and Eastern Indonesia (9.9%). Regarding artificial intelligence experience, 23.4% reported less than six months of usage, 38.2% reported six to twelve months, and 38.4% reported more than twelve months. Google Classroom was the most commonly used learning management system platform (52.7%), followed by Moodle (28.1%) and institutional or other platforms (19.2%).

Table 4. Demographic Profile of Respondents (N = 385)

Variable	Category	n	%
Role	Lecturer	185	48.1
	Student	200	51.9
Gender	Male	203	52.7
	Female	182	47.3
Age	< 25 years	114	29.6
	25–35 years	146	37.9
	36–45 years	78	20.3
	> 45 years	47	12.2
Institution	State Islamic University	136	35.3
	State Islamic Institute	129	33.5
	Private Islamic Institution	120	31.2
Artificial intelligence experience	< 6 months	90	23.4
	6–12 months	147	38.2
	> 12 months	148	38.4
Learning management system platform	Google Classroom	203	52.7
	Moodle	108	28.1
	Institutional/Other	74	19.2

4.2. Descriptive Statistics

Mean construct scores ranged from 3.48 (Facilitating Conditions, the lowest) to 4.21 (Islamic Work Ethic, the highest), suggesting general agreement with the measurement items but a perceived shortfall in technical infrastructure. The high Islamic Work Ethic score signals strong endorsement of Islamic professional values across the sample. Standard deviations ranged from 0.61 to 0.89, indicating moderate response variability. Skewness and kurtosis values fell within ± 1.0 , confirming approximate univariate normality at the indicator level.

Table 5. Descriptive Statistics of Constructs (N = 385)

Construct	Mean	SD	Skewness	Kurtosis
Performance Expectancy (PE)	3.94	0.72	-0.41	0.18
Effort Expectancy (EE)	3.87	0.68	-0.33	0.12

Construct	Mean	SD	Skewness	Kurtosis
Social Influence (SI)	3.76	0.79	-0.28	-0.15
Facilitating Conditions (FC)	3.48	0.89	-0.19	-0.34
Islamic Work Ethic (IWE)	4.21	0.61	-0.67	0.52
Theological Trust (TIT)	3.62	0.78	-0.22	-0.08
Behavioural Intention (BI)	3.89	0.74	-0.38	0.21
Use Behaviour (UB)	3.57	0.83	-0.16	-0.27

4.3. Measurement Model Assessment

All indicator outer loadings exceeded the 0.708 threshold, falling between 0.714 and 0.892. Average Variance Extracted values ranged from 0.573 to 0.691, exceeding the 0.50 minimum and confirming that each construct explains more than half of the variance in its indicators. Composite Reliability values ranged from 0.843 to 0.918, and Cronbach's alpha values ranged from 0.768 to 0.887, all above 0.70 and below 0.95. All 32 items were retained in the final measurement model. The retention of the full item set follows from the rigorous adaptation and pilot testing conducted prior to data collection, which allowed problematic wording to be revised in advance rather than dropped after the fact.

Table 6. Convergent Validity and Reliability Assessment

Construct	Items	Loading Range	AVE	CR	Cronbach α
PE	PE1-PE4	0.782-0.861	0.672	0.891	0.837
EE	EE1-EE4	0.754-0.845	0.638	0.876	0.812
SI	SI1-SI4	0.736-0.867	0.647	0.880	0.819
FC	FC1-FC4	0.714-0.842	0.612	0.863	0.789
IWE	IWE1-IWE5	0.758-0.892	0.658	0.906	0.871
TIT	TIT1-TIT4	0.769-0.853	0.663	0.887	0.831
BI	BI1-BI4	0.812-0.878	0.691	0.870	0.768
UB	UB1-UB3	0.741-0.856	0.573	0.843	0.793

Note: All loadings exceed 0.708; AVE exceeds 0.50; CR exceeds 0.70; α exceeds 0.70. Thresholds met for all constructs.

Discriminant validity was assessed through the Heterotrait-Monotrait ratio. All values fell between 0.387 and 0.793, well below the conservative threshold of 0.85. The highest value occurred between Performance Expectancy and Behavioural Intention (0.793), which is theoretically expected given their strong hypothesised relationship while still indicating empirical distinctness.

Table 7. Discriminant Validity: Heterotrait-Monotrait Ratio Matrix

	PE	EE	SI	FC	IWE	TIT	BI	UB
PE	—							
EE	0.654	—						
SI	0.523	0.498	—					
FC	0.478	0.561	0.412	—				
IWE	0.512	0.387	0.445	0.398	—			
TIT	0.489	0.423	0.467	0.534	0.578	—		
BI	0.793	0.612	0.634	0.487	0.667	0.623	—	
UB	0.567	0.489	0.512	0.623	0.534	0.498	0.756	—

4.4. Structural Model Assessment

Inner Variance Inflation Factor values ranged from 1.234 to 2.187, all below the 3.0 ideal benchmark, ruling out problematic collinearity. Bootstrapping with 5,000 subsamples and Bias-Corrected and Accelerated confidence intervals produced the path coefficients displayed in Table 8 and visualised in Figure 2.

Key findings at a glance.

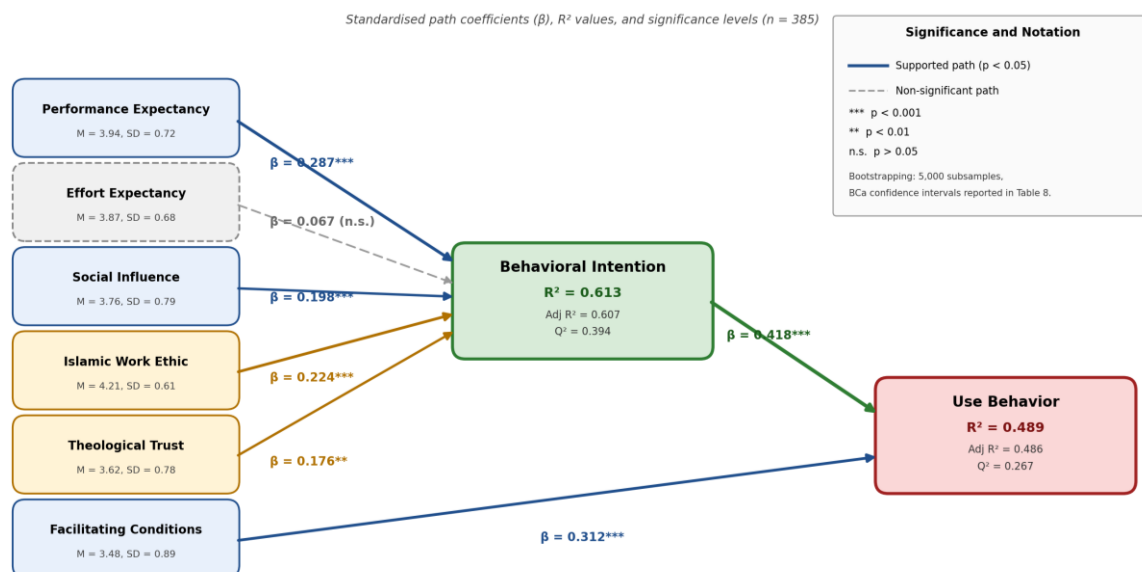
Four findings stand out and structure the discussion that follows. First, Performance Expectancy is the strongest antecedent of Behavioural Intention ($\beta = 0.287, p < 0.001$), which is the expected pattern. Second, and against the original Unified Theory specification, Effort Expectancy is non-significant ($\beta = 0.067, p = 0.182$), indicating that perceived ease of use is no longer a primary barrier in this digitally exposed sample. Third, Islamic Work Ethic is the second strongest antecedent ($\beta = 0.224, p < 0.001$), placing ahead of Social Influence and validating its specification as a direct predictor rather than a moderator. Fourth, Theological Trust significantly predicts Behavioural Intention ($\beta = 0.176, p = 0.001$), establishing the empirical relevance of doctrinal trust calibration in artificial-intelligence-mediated Islamic education.

Table 8. Structural Model: Path Coefficients and Hypothesis Testing

H	Path	β	SD	T	P	95% BCa CI	f ²	Decision
H1	PE → BI	0.287	0.052	5.519	<0.001	[0.187, 0.391]	0.098	Supported
H2	EE → BI	0.067	0.050	1.340	0.182	[-0.029, 0.168]	0.005	Not supported
H3	SI → BI	0.198	0.054	3.667	<0.001	[0.094, 0.307]	0.051	Supported
H4	FC → UB	0.312	0.049	6.367	<0.001	[0.219, 0.411]	0.134	Supported
H5	IWE → BI	0.224	0.048	4.667	<0.001	[0.132, 0.319]	0.067	Supported
H6	TIT → BI	0.176	0.053	3.321	0.001	[0.074, 0.281]	0.038	Supported
H7	BI → UB	0.418	0.047	8.894	<0.001	[0.328, 0.513]	0.239	Supported

Note: PE = Performance Expectancy; EE = Effort Expectancy; SI = Social Influence; FC = Facilitating Conditions; IWE = Islamic Work Ethic; TIT = Theological Trust; BI = Behavioural Intention; UB = Use Behaviour. β values are standardised path coefficients; BCa CI denotes bias-corrected and accelerated bootstrap confidence intervals from 5,000 subsamples; f² values are interpreted against Cohen's benchmarks (0.02 small, 0.15 medium, 0.35 large) [34].

Read together, the path coefficients reveal three interpretive patterns. The model explains 61.3% of variance in Behavioural Intention ($R^2 = 0.613$, adjusted $R^2 = 0.607$) and 48.9% of variance in Use Behaviour ($R^2 = 0.489$, adjusted $R^2 = 0.486$), placing it in the moderate-to-substantial range for educational technology adoption studies. Stone-Geisser Q² values from blindfolding (0.394 for Behavioural Intention; 0.267 for Use Behaviour) lie comfortably above zero, confirming that the model is predictive rather than merely descriptive. The ordering of antecedents to Behavioural Intention is theoretically meaningful: Performance Expectancy, then Islamic Work Ethic, then Social Influence, then Theological Trust. The placement of Islamic Work Ethic ahead of Social Influence is the result that most clearly invites theoretical revision, since it shows ethical alignment operating as a first-order driver of adoption rather than a peripheral concern.

Figure 2. Structural model results with standardised path coefficients and R² values.

4.5. Multi-Group Analysis: Lecturers vs. Students

The Measurement Invariance of Composite Models procedure confirmed configural invariance and compositional invariance across the two subgroups (all permutation correlations close to 1.00, $p > 0.05$), establishing partial measurement invariance sufficient for Multi-Group Analysis. Two of the seven structural paths differed significantly across groups. The Performance Expectancy to Behavioural Intention path was stronger for lecturers ($\beta = 0.352$) than for students ($\beta = 0.228$), with $|\Delta\beta| = 0.124$ and $p = 0.032$. The Social Influence to Behavioural Intention path ran the other way, stronger for students ($\beta = 0.267$) than for lecturers ($\beta = 0.134$), with $|\Delta\beta| = 0.133$ and $p = 0.024$. The remaining five paths did not differ significantly, indicating that Islamic Work Ethic, Theological Trust, Facilitating Conditions, Effort Expectancy, and the intention-to-behaviour link operate similarly for both groups. Hypothesis 8 is therefore partially supported: the structural model is largely invariant across stakeholder roles, with role-specific differences confined to the Performance Expectancy and Social Influence pathways.

Table 9. Multi-Group Analysis: Lecturer vs. Student Subgroup Comparison

Path	β Lecturer	β Student	$ \Delta\beta $	P-value	Significant
PE \rightarrow BI	0.352	0.228	0.124	0.032	Yes
EE \rightarrow BI	0.043	0.089	0.046	0.387	No
SI \rightarrow BI	0.134	0.267	0.133	0.024	Yes
IWE \rightarrow BI	0.256	0.194	0.062	0.198	No
TIT \rightarrow BI	0.213	0.142	0.071	0.156	No
FC \rightarrow UB	0.287	0.334	0.047	0.341	No
BI \rightarrow UB	0.394	0.439	0.045	0.367	No

4.6. Common Method Bias and Robustness Checks

Two complementary procedures assessed common method bias. Harman's single-factor test returned a first factor accounting for 28.4% of variance, well below the 50% threshold. Kock's full collinearity assessment returned variance inflation factors between 1.43 and 2.19, all below the 3.30 threshold. Two robustness considerations qualify how the structural model should be read. First, the Multi-Group Analysis is best treated as exploratory, since lecturer and student subgroups come from the same twelve institutions and unobserved institutional culture may load on both groups. Second, the convergence of three sample-size approaches and the bias-corrected and accelerated bootstrap confidence intervals jointly support the statistical stability of the path coefficients.

Overall, these diagnostic and robustness checks indicate that the structural relationships identified in the model are sufficiently stable and unlikely to be substantially distorted by common method bias. With the validity and robustness of the model established, the discussion can now turn to interpreting the substantive meaning of the findings in relation to prior technology acceptance research, Islamic educational values, and entrepreneurial leadership theory.

This study examined the determinants of artificial intelligence and learning management system adoption among lecturers and students in Islamic Educational Management programmes across Indonesian Islamic higher education institutions, using an extended Unified Theory of Acceptance and Use of Technology that incorporates Islamic Work Ethic and Theological Trust. The discussion proceeds by linking each empirical finding with prior scholarship while identifying points of convergence and divergence with existing evidence. To maintain conceptual consistency, the interpretation is framed through the lens of entrepreneurial leadership, which emphasises innovativeness, value-driven leadership, social mobilisation, resource acquisition, risk management, and opportunity exploitation [21], [22].

Performance Expectancy emerged as the strongest predictor of Behavioural Intention ($\beta = 0.287$), confirming prior international meta-analytic evidence and recent Indonesian studies showing that users adopt technology when it is perceived to improve teaching and learning outcomes [12]-[14]. However, the present findings indicate that in Islamic Educational Management contexts, perceived usefulness extends beyond instrumental efficiency. The Islamic concept of *itqan*, which emphasises professional excellence, appears to frame the use of artificial intelligence and learning management systems as part of a moral obligation to improve educational quality [34]. This suggests that Performance Expectancy in Islamic higher education partly reflects religiously grounded responsibility rather than purely utilitarian calculation. Within entrepreneurial leadership theory, this aligns with the innovativeness dimension of leadership, where leaders pursue new approaches that enhance institutional performance [21], [22].

In contrast, Effort Expectancy did not significantly predict Behavioural Intention ($\beta = 0.067$, $p = 0.182$). Although this finding departs from the original Unified Theory, it is consistent with post-pandemic evidence suggesting that ease of use becomes less influential once users achieve a basic level of technological familiarity. In the present study, a substantial proportion of respondents had more than twelve months of artificial intelligence experience, indicating that usability concerns may no longer be the primary barrier to adoption [49]. Instead, respondents appear more concerned with whether technologies align with educational goals, institutional support, and religious values. Nevertheless, this result should not be interpreted universally. Previous studies involving Indonesian elementary school teachers found Effort Expectancy to be the strongest determinant of intention [51], implying that the relevance of usability depends heavily on users' level of digital exposure. The implication of this finding is that digital transformation strategies in Islamic higher education should move beyond interface simplification and focus more strongly on institutional alignment, pedagogical relevance, and leadership readiness.

Social Influence significantly predicted Behavioural Intention ($\beta = 0.198$), with the effect substantially stronger among students than lecturers ($\beta = 0.267$ vs. 0.134 , $p = 0.024$). This finding reflects the collectivist orientation of Indonesian society and the pesantren tradition of *ta'dhim*, where respect for teachers and authority figures strongly shapes behaviour. Previous studies of pesantren leadership structures have similarly shown that the authority of the *kyai* creates vertical normative channels that influence both lecturers and students [52]. The stronger student response to social influence also aligns with comparative studies documenting differing adoption pathways between students and faculty members [53]. Practically, the implication is that technology adoption

strategies should be differentiated by stakeholder group. Lecturers are more likely to respond to endorsement from respected senior faculty and institutional leaders, whereas students are more strongly influenced by peer networks, mentor circles, and cohort-based mobilisation initiatives. From an entrepreneurial leadership perspective, this reflects the importance of social mobilisation in driving institutional change [21], [22].

Alongside social influence, Facilitating Conditions directly predicted Use Behaviour ($\beta = 0.312$) and recorded the lowest mean score among all constructs ($M = 3.48$), indicating that infrastructure remains the principal constraint on actual technology use. This finding differs from studies conducted in more technologically developed university environments, such as China, where Facilitating Conditions often exert weaker effects [45]. In Islamic higher education, infrastructure encompasses more than technical hardware or internet access. It also includes artificial intelligence systems capable of handling Arabic-script inputs, learning management systems compatible with pesantren academic structures, and information technology support personnel who understand Islamic educational workflows. The implication is that infrastructure should not be viewed merely as a technical issue, but as a leadership and institutional governance issue requiring strategic investment and resource coordination [30].

One of the most distinctive findings in the study is the significant effect of Islamic Work Ethic on Behavioural Intention ($\beta = 0.224$), making it the second strongest determinant after Performance Expectancy. This finding represents an important novelty of the study because previous research has generally treated religious values as moderators of conventional acceptance variables [16], [17], whereas the present findings demonstrate that Islamic ethical orientation functions as a direct predictor of technology adoption. Three concepts help explain this relationship. First, *itqan* frames the pursuit of educational excellence as a religious duty. Second, *amanah* positions artificial intelligence and learning management systems as tools that help educators fulfil their trust and responsibility toward students. Third, *tajdid*, or renewal, provides theological justification for adopting new methods and technologies in the pursuit of knowledge. Together, these concepts transform Islamic Work Ethic from a contextual background variable into an active motivational force. This interpretation is supported by broader scholarship arguing that ethical commitments in Muslim societies operate as substantive drivers of organisational behaviour rather than merely symbolic values [55], [56]. Empirical studies also show that Islamic Work Ethic promotes innovative work behaviour, knowledge sharing, job satisfaction, and organisational commitment [40], [41]. Within entrepreneurial leadership theory, the construct corresponds closely to value-driven leadership, where leaders motivate followers through shared moral commitments [21]-[23]. The implication is that institutional technology policies in Islamic higher education should integrate Islamic ethical principles as foundational drivers of digital transformation rather than as symbolic religious additions to secular policy frameworks.

The findings also demonstrate that Theological Trust significantly predicted Behavioural Intention ($\beta = 0.176$, $p = 0.001$), although with a relatively small effect size ($f^2 = 0.038$). Unlike conventional trust constructs that focus on reliability, privacy, or technical security, Theological Trust captures concerns regarding the doctrinal accuracy of artificial intelligence-generated religious content [18], [20]. The inclusion of Theological Trust constitutes another important novelty of this study because it extends conventional technology acceptance theory into the domain of doctrinal and theological legitimacy. The relatively small effect size may indicate that Theological Trust functions as a threshold variable: insufficient trust strongly inhibits adoption, whereas trust beyond an acceptable baseline produces diminishing returns [57]. The effect may also be underestimated because the study combined artificial intelligence and learning management systems into a single category, despite theological concerns being more directly associated with artificial intelligence outputs. Recent scholarship on contemporary Islamic jurisprudence similarly argues that Muslim societies require contextual and adaptive interpretations capable of engaging technological change while preserving doctrinal principles [58]. The implication for institutional leadership is that faith-based educational institutions must establish theological verification mechanisms and doctrinal review systems when integrating artificial intelligence into Islamic learning environments.

Behavioural Intention strongly predicted Use Behaviour ($\beta = 0.418$, $f^2 = 0.239$), confirming the central intention-behaviour relationship proposed in the Unified Theory. The R^2 value for Use Behaviour (0.489) is comparable to meta-analytic averages reported in technology acceptance research [59]. However, the findings also indicate the persistence of an intention-behaviour gap [60]. In Islamic higher education contexts, this gap likely reflects competing pedagogical traditions, lecturer workload, limited Arabic-language digital resources, and institutional inertia. Entrepreneurial leadership therefore becomes essential for translating positive intention into sustained institutional practice through training, policy support, and organisational restructuring [21], [22]. Importantly, multi-group analysis revealed that most structural relationships were invariant across lecturers and students, with differences concentrated mainly in Performance Expectancy and Social Influence pathways. This suggests that Islamic Work Ethic and Theological Trust operate as stable determinants across demographic and professional categories, reinforcing their status as foundational constructs within Islamic higher education technology adoption.

Taken together, the findings support an Islamically contextualised extension of the Unified Theory of Acceptance and Use of Technology. Incorporating Islamic Work Ethic and Theological Trust increased the

explanatory power of the model, raising the R^2 for Behavioural Intention to 0.613, which exceeds values commonly reported in higher education technology acceptance studies [51], [62]. The novelty of the study lies not only in introducing Islamic Work Ethic and Theological Trust as direct determinants of Behavioural Intention, but also in interpreting these constructs through an entrepreneurial leadership lens that connects technological adoption with value-driven leadership, social mobilisation, resource acquisition, and doctrinal risk management. Rather than replacing the Unified Theory, the entrepreneurial leadership framework extends it into a model suitable for faith-based educational institutions, where technology adoption decisions are inseparable from institutional identity and ethical leadership.

The study also offers several theoretical and practical implications. Theoretically, the findings demonstrate that context-specific ethical and theological variables can significantly improve the explanatory power of technology acceptance models in faith-based educational settings. Practically, Islamic higher education institutions should prioritise outcome-based training programmes demonstrating the pedagogical and administrative benefits of artificial intelligence and learning management systems. Student-focused peer ambassador programmes and mentor circles should also be developed to utilise the strong social influence pathways identified among students. In addition, institutions should establish theological verification mechanisms for artificial intelligence-generated Islamic content through expert review panels and doctrinal compliance procedures. At the policy level, national frameworks for Islamic higher education could integrate Islamic Work Ethic principles into digital transformation strategies and include entrepreneurial leadership capacity as an accreditation indicator for Islamic Educational Management programmes [63], [64].

Despite these contributions, several limitations should be acknowledged. First, the cross-sectional design limits causal interpretation, making longitudinal studies necessary to examine how Islamic Work Ethic and Theological Trust evolve throughout different stages of technology adoption. Second, the purposive sampling of twelve institutions, with an overrepresentation of Sumatran institutions, limits broader generalisation across Indonesian Islamic higher education. Third, although diagnostic procedures indicated that common method bias was not severe, reliance on single-source survey data remains a methodological limitation. Fourth, the study combined artificial intelligence and learning management systems into a single technology category, despite the possibility that each technology raises distinct pedagogical and theological issues. These limitations provide several directions for future research, including longitudinal and multi-level analyses, comparative studies across Muslim-majority educational systems, and qualitative investigations of leadership practices in high-adoption and low-adoption institutions. Future research should also explore how informal digital learning environments, including social media platforms used by Generation Z students for Islamic learning activities, interact with formal learning management systems in shaping technology adoption pathways within Islamic higher education.

5. CONCLUSION

This study examined how lecturers and students in Indonesian Islamic Educational Management programmes adopt artificial intelligence and learning management systems by extending the Unified Theory of Acceptance and Use of Technology with Islamic Work Ethic and Theological Trust and reading the resulting structural relationships through an entrepreneurial leadership lens. Performance Expectancy, Islamic Work Ethic, Social Influence, and Theological Trust significantly predicted Behavioural Intention; Effort Expectancy did not; and Behavioural Intention together with Facilitating Conditions predicted Use Behaviour, with the model explaining 61.3% of variance in intention and 48.9% of variance in use. The Multi-Group Analysis showed that Performance Expectancy operates more strongly among lecturers and Social Influence operates more strongly among students, while value-based and trust-based pathways are largely invariant across roles. The principal contributions are the empirical repositioning of Islamic Work Ethic as a direct predictor rather than a moderator of technology adoption intention, the introduction of Theological Trust as a construct that captures concerns about the doctrinal accuracy of artificial intelligence outputs in Islamic content, and the integrative entrepreneurial leadership reading that ties innovativeness, social mobilization, value-driven leadership, risk management, and resource acquisition to the structural model. Future research should pursue longitudinal panel designs to establish temporal ordering, multi-level modelling to account for institutional clustering, qualitative case studies of high-adopting and low-adopting institutions, and comparative studies across Muslim-majority educational systems to test the transferability of the extended model.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the cooperation of the twelve Islamic higher education institutions that facilitated data collection, as well as the lecturers and students of Islamic Educational Management programmes who participated in the survey. This research received no external funding.

AUTHOR CONTRIBUTIONS

Conceptualisation, M.N. and M.H.R.ZH.; Methodology, M.N. and E.P.; Software, M.H.R.ZH.; Validation, M.N., E.P., and M.K.N.A.A.; Formal Analysis, M.N. and M.H.R.ZH.; Investigation, M.N., E.P., R.H., and R.; Resources, E.P., R.H., and R.; Data Curation, M.H.R.ZH., R.H., and R.; Writing Original Draft, M.N.; Writing Review and Editing, M.K.N.A.A. and E.P., R.H.; Visualisation, M.H.R.ZH.; Supervision, M.N. and M.K.N.A.A.; Project Administration, M.N. and E.P. All authors have read and agreed to the published version of the manuscript.

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study. Prior to participation, each respondent was provided with a clear explanation of the study's objectives, procedures, data confidentiality measures, and the voluntary nature of participation. All participants gave their consent before completing the online survey.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

During the preparation of this manuscript, the authors used Claude (Anthropic) to assist with English language editing, paraphrasing, and the initial drafting of selected discussion paragraphs that connect empirical results to prior literature. Artificial-intelligence-assisted tools were also used to generate alternative phrasings and to support the structural organisation of the manuscript. All artificial-intelligence-generated text was critically reviewed, substantively revised, and verified against original sources by the authors. All conceptual contributions, hypotheses, theoretical framing, data analysis, interpretation of results, and final wording remain the authors' own. The authors take full responsibility for the content of this publication.

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