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The interplay of financial literacy, digital finance adoption, and behavioral biases in investment decision-making: A integrated model for emerging markets

Vu Hiep HOANG[1], Thi Lan Huong LE[2*]

[1,2]*National Economics University, Vietnam.*

Corresponding author: Thi Lan Huong LE (*Email: lelanhuong@neu.edu.vn*)

Abstract

This research addresses a critical gap in contemporary financial scholarship by developing an integrated theoretical framework that examines the complex interrelationships between financial literacy, digital finance adoption, and behavioral biases in investment decision-making within the Vietnamese emerging market context. The study transcends traditional siloed approaches that have examined these constructs in isolation, instead offering a conceptually integrated model that captures their multidirectional relationships. Drawing on a sophisticated methodological architecture, this study employs structural equation modeling (SEM) with data collected from 452 retail investors in Vietnam. The quantitative analysis is complemented by fuzzy-set qualitative comparative analysis (fsQCA) to identify configurational pathways to investment success. The epistemic trajectory reveals that digital financial literacy serves as both a mediator and a moderator in the relationship between behavioral biases and investment decisions in the Vietnamese context. Multigroup analysis further illuminates substantial heterogeneity across demographic segments, with particularly pronounced digital literacy effects among younger investors. The hermeneutic analysis uncovers how overconfidence and herding biases manifest within Vietnam's digitally-mediated investment environments, reflecting distinctive cultural and institutional characteristics. This research develops a comprehensive integration of financial literacy, digital adoption, and behavioral finance theories, advancing a nuanced understanding of investment behavior that accounts for the institutional, technological, and psychological dimensions unique to Vietnam's emerging market context.

Keywords: Behavioral biases, Digital finance adoption, Financial literacy, Investment decisions, Risk perception, fsQCA, Structural equation modeling, Vietnam.

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1. Introduction

The global financial ecosystem is undergoing a profound transformation through rapid digitalization, expanding financial inclusion initiatives, and increasing retail investor participation in emerging markets [1, 2]. Emerging markets present a particularly compelling research context with their distinctive combination of accelerating digital adoption rates, expanding retail investment participation, and relatively young populations navigating financial markets amidst dynamic tensions between traditional structures and digital transformation [3, 4].

The current trajectory of investment behavior research reveals a critical lacuna: whilst financial literacy, technological adoption, and behavioral biases have attracted substantial scholarly attention individually, their interactive relationships remain theoretically underexplored and empirically undertested, particularly within emerging market socioeconomic contexts [3, 5]. This fragmentation represents a significant impediment to understanding contemporary investment behavior in rapidly evolving market environments [6].

This theoretical insufficiency manifests through five interconnected dimensions: First, prevailing financial literacy conceptualizations inadequately incorporate digital competencies essential for navigating technological leapfrogging phenomena in emerging markets, where sophisticated digital financial engagement frequently precedes traditional financial knowledge acquisition [6-8]. Second, digital finance adoption research predominantly employs utilitarian-focused technology acceptance models, neglecting how digital interfaces potentially amplify or mitigate cognitive biases within distinctive cultural-institutional environments of emerging economies [3, 9]. Third, behavioral finance studies insufficiently examine how cognitive biases transform within digitally mediated environments and collectivist cultural contexts predominant in many emerging markets [10-12]. Fourth, integrative theoretical frameworks capturing the complex interrelationships between knowledge structures, technological engagement, and psychological predispositions remain notably absent in emerging market scholarship [10, 13]. Fifth, existing research inadequately accounts for distinctive contextual features of emerging markets where hybrid regulatory approaches, balancing market liberalization with state oversight, create unique investment decision-making environments requiring contextually sensitive theoretical frameworks [1, 10].

This research contributes a novel Digital-Behavioral Investment Decision Framework that conceptualizes investment decisions as emerging from complex interactions between multidimensional financial literacy (traditional and digital), digital finance adoption patterns, and behavioral biases (overconfidence, herding, disposition effect), all embedded within specific institutional and cultural contexts of emerging markets. This framework enables: (i) validation of a multidimensional financial literacy conceptualization encompassing digital competencies, (ii) examination of digital finance's mediating role between literacy and investment quality, (iii) investigation of behavioral biases in digitally mediated contexts, (iv) identification of emerging market-specific contextual moderators, and (v) derivation of theoretical insights with practical implications for enhancing investment outcomes in emerging markets undergoing rapid digital transformation.

2. Literature Review & Hypotheses Development

2.1. Theoretical Foundations

2.1.1. Integration of Financial Literacy and Digital Competence

Traditional financial literacy paradigms have historically centered upon knowledge structures requisite for effective financial decision-making [7]. However, the accelerating digitalization of financial ecosystems necessitates a paradigmatic reconceptualization that transcends unidimensional frameworks. Digital financial literacy emerges not as a mere additive extension but as an ontologically distinct construct with emergent properties reflecting the synthesis of traditional financial knowledge and technological competencies [14, 15].

This theoretical reconfiguration acquires heightened salience within emerging market contexts where rapid technological diffusion creates distinctive developmental trajectories. The evidence demonstrates digital competencies' significant influence on financial technology adoption [3] and investment behavior modulation [16]. Particularly consequential is the "asymmetric literacy development" phenomenon wherein technological competencies frequently

outpace traditional financial knowledge acquisition, especially among younger demographic cohorts [17]. This pattern necessitates multidimensional conceptualizations that differentiate between traditional and digital financial literacy dimensions [18].

2.1.2. Behavioral Finance and Cognitive Bias Theory

Behavioral finance theory fundamentally challenges rational actor paradigms, illuminating how psychological factors systematically influence investment decisions within environments characterized by complexity and information asymmetry [8, 19, 20]. Three biases warrant particular attention in emerging markets' digital contexts: overconfidence bias, herding bias, and disposition effect. These cognitive predispositions manifest distinctly within culturally specific digital environments, herding behavior intensifies through collectivist cultural orientations and social media penetration [10] whilst disposition effects strengthen in contexts where loss realization carries heightened social stigma [21].

2.1.3. Technology Acceptance and Digital Finance Adoption

Comprehending digital finance adoption requires theoretical integration that transcends conventional technology acceptance frameworks. Emerging market contexts introduce critical dimensions beyond utilitarian considerations, namely, trust architectures, security perceptions, and risk assessment protocols [3]. Research indicates adoption patterns are shaped by complex interplays between technological affordances, psychological predispositions, and cultural matrices [9]. Intra-country variations in technological infrastructure create heterogeneous adoption landscapes, requiring nuanced theoretical approaches [22] whilst institutional trust emerges as a decisive mediator between regulatory perceptions and platform engagement willingness [1].

2.2. Review of Relevant Studies

2.2.1. Multidimensional Financial Literacy Landscapes

Transdisciplinary scholarship posits that financial literacy functions as a critical mediator in investment ecologies across emerging market contexts. The epistemic trajectory reveals significant moderation effects between social influence mechanisms and investment decision architectures [16] whilst financial knowledge structures demonstrate predictive validity for digital financial service adoption and subsequent management behaviors [3].

The hermeneutic analysis uncovers distinctive literacy configurational patterns within emerging market investors, demonstrating enhanced proficiency in savings instruments and rudimentary financial calculations, whilst exhibiting attenuated comprehension of risk diversification principles and complex financial architectures [8]. This asymmetrical knowledge distribution reflects deep cultural embeddings prioritizing conservation over growth-oriented financial behaviors, a paradigm that persists despite accelerating financialization dynamics.

Byegon's [23] longitudinal investigation provides particularly illuminating insights into the distinctive developmental trajectories of financial literacy within emerging markets. The evidence documents a "leapfrogging" phenomenon wherein digital competencies frequently outpace traditional financial knowledge acquisition, especially among younger demographic cohorts. This creates ontologically distinct literacy profiles that diverge substantially from developmental sequences observed in mature market contexts, where traditional financial knowledge typically precedes digital competence acquisition.

Demographic stratification analyses reveal significant cross-cohort heterogeneity. Younger investors (18-35) typically exhibit elevated digital financial literacy coupled with attenuated traditional financial knowledge, whilst inverse patterns manifest among older investors [4]. This generational bifurcation generates distinctive literacy-investment relationship matrices across age strata. Spatial analyses further illuminate significant urban-rural disparities across literacy dimensions, with particularly pronounced digital literacy asymmetries between metropolitan and provincial regions [24].

2.2.2. Digital Finance Adoption: Sociocultural Embeddedness

The digital finance landscape in emerging markets demonstrates distinctive adoption architectures shaped by complex interactions between technological infrastructures, regulatory frameworks, and cultural matrices. Empirical investigations in Vietnam identify multifaceted adoption determinants for mobile wallet technologies, highlighting the significance of perceived utility, social image considerations, and risk perception matrices [3]. Complementary research shows how social influence mechanisms significantly modulate investment decision processes, with digital platforms amplifying peer effect mechanisms [9].

Emerging market digital finance ecosystems exhibit several distinctive characteristics: exceptional mobile penetration creating fertile environments for mobile-centric financial services, coupled with persistent cash utilization generating hybrid transactional environments where digital and traditional channels coexist in complex equilibria [1]. Regional comparative analyses reveal significant spatial heterogeneity in adoption patterns, with substantial disparities in service availability, utilization protocols, and technological infrastructure [22].

Trust emerges as a particularly critical mediator in digital finance adoption, with the evidence demonstrating a significant influence of trust perceptions on adoption behaviors [3] and platform security assessments on investment engagement willingness [9]. The institutional dimensions of trust acquire particular salience, with perceptions of regulatory adequacy functioning as significant predictors of platform trust [1].

2.2.3. Behavioral Bias Manifestations in Digital-Cultural Contexts

Behavioral biases demonstrate context-specific manifestations within digitally mediated investment environments across emerging markets. Herding behavior significantly influences investment decisions, with social media platforms

functioning as amplification mechanisms [10]. Indonesian investigations document how digital interfaces, particularly social trading applications and investment-oriented social media communities, generate distinctive information cascade architectures that intensify herding tendencies [21].

Digital platforms interact with behavioral predispositions in distinctive ways across emerging markets, with the evidence suggesting strong loss aversion tendencies among digital financial service users [3]. This indicates bidirectional relationships where psychological predispositions influence not only investment decisions but also technology adoption patterns themselves, creating complex feedback mechanisms between technological engagement and behavioral biases.

The disposition effect manifests with heightened intensity in emerging markets characterized by collectivist orientations. Experimental evidence from Gulf investors documents amplified disposition effects compared to individualistic contexts, attributed to elevated social stigma associated with loss realization in face-conscious societies [10]. This effect intensifies when investment outcomes acquire visibility through social trading platforms, suggesting digital interfaces may function as bias amplification mechanisms by increasing outcome social visibility.

2.2.4. Vietnam's Contextual Configuration

Vietnam presents a distinctive contextual matrix that significantly modulates financial literacy-adoption-bias relationships. Its regulatory approach represents a calibrated equilibrium between innovation facilitation and consumer protection, whilst infrastructure heterogeneity creates significant digital access disparities between urban and rural regions [3]. These contextual elements warrant integration into comprehensive behavioral finance models to enhance the theoretical and empirical understanding of investment decision architectures within Vietnam's specific institutional, cultural, and technological landscape.

2.3. Hypothesis Formulation and Proposed Research Model

2.3.1. Financial Literacy and Investment Decisions

Based upon the empirical evidence linking financial literacy to investment outcomes in emerging markets [3, 24], this investigation posits direct positive relationships between financial literacy dimensions and investment decision quality:

$H_{1a:}$ General financial literacy is positively associated with investment decision quality.

$H_{1b:}$ Digital financial literacy is positively associated with investment decision quality.

These hypotheses build upon the findings of studies such as Joshi and Rawat [16], which demonstrated that financial literacy significantly influenced investment decisions among emerging market investors, and Le et al. [3], which found that financial knowledge predicted financial management behaviors in digital contexts. Additionally, they extend the work of Byegon [23], which documented the distinctive impact of traditional and digital financial literacy dimensions on financial decision-making in rapidly digitalizing environments.

2.3.2. Digital Finance Adoption as Mediator

Based on evidence suggesting that digital finance tools enhance access to investment opportunities and facilitate more informed decision-making in emerging markets [3, 24], this research hypothesizes that digital finance adoption mediates the relationship between financial literacy and investment outcomes:

H2a: Digital finance adoption mediates the relationship between general financial literacy and investment decision quality.

H2b: Digital finance adoption mediates the relationship between digital financial literacy and investment decision quality.

These hypotheses are informed by studies such as Le et al. [3] which found that digital financial service adoption influenced financial management behaviors among emerging market consumers, suggesting a potential mediating role in the relationship between financial knowledge and financial outcomes. They also build upon the insights of Nugraha et al. [22] which highlighted how digital finance platforms can bridge information gaps and enhance decision-making capabilities among emerging market investors, potentially mediating the relationship between knowledge structures and investment outcomes.

2.3.3. Risk Perception as Mediator

Drawing upon evidence that risk perception plays a crucial role in translating financial knowledge into investment decisions in emerging market contexts [3, 10] this investigation hypotheses:

H3a: Risk perception mediates the relationship between general financial literacy and investment decision quality amongst emerging market investors.

H3b: Risk perception mediates the relationship between digital financial literacy and investment decision quality among emerging market investors.

These hypotheses build upon findings from studies such as Le et al. [3], which demonstrated that risk perceptions significantly influenced financial technology adoption decisions among emerging market consumers, suggesting an important role in the relationship between financial knowledge and financial behaviors. They also extend the work of Almansour et al. [10], which documented how different dimensions of financial literacy shape risk perception and risk management capabilities among emerging market investors, potentially mediating the relationship between financial knowledge and investment outcomes.

2.3.4. Behavioral Biases and Investment Decisions

Based upon evidence regarding the impact of behavioral biases on investment decisions in emerging markets [10, 21], this research hypothesizes negative relationships between key biases and investment decision quality:

H_{4a}: Overconfidence bias is negatively associated with investment decision quality amongst emerging market investors.

H_{4b}: Herding bias is negatively associated with investment decision quality amongst emerging market investors.

H_{4c}: Disposition effect is negatively associated with investment decision quality amongst emerging market investors.

These hypotheses are grounded in findings from Almansour et al. [10], which documented significant effects of herding behavior on investment decisions amongst Gulf investors, and Denura and Soekarno [21] who observed strong bias tendencies amongst Indonesian cryptocurrency investors. They also build upon the culturally-specific insights of studies examining behavioral biases in emerging markets' contexts.

2.3.5. Financial Literacy as Moderator of Bias Effects

Drawing upon evidence that financial literacy can mitigate the impact of behavioral biases in emerging markets [8, 20] and specifically in developing economies [25], this investigation hypothesizes:

H_{5a}: General financial literacy moderates the relationship between overconfidence bias and investment decision quality, such that the negative relationship is weaker for investors with higher general financial literacy.

H_{5b}: Digital financial literacy moderates the relationship between overconfidence bias and investment decision quality, such that the negative relationship is weaker for investors with higher digital financial literacy.

H_{5c}: General financial literacy moderates the relationship between herding bias and investment decision quality, such that the negative relationship is weaker for investors with higher general financial literacy.

H_{5d}: Digital financial literacy moderates the relationship between herding bias and investment decision quality, such that the negative relationship is weaker for investors with higher digital financial literacy.

H_{5e}: General financial literacy moderates the relationship between disposition effect and investment decision quality, such that the negative relationship is weaker for investors with higher general financial literacy.

H_{5f}: Digital financial literacy moderates the relationship between disposition effect and investment decision quality, such that the negative relationship is weaker for investors with higher digital financial literacy.

These hypotheses extend findings from Mishra et al. [24], which found that financial literacy moderated the influence of social factors on investment decisions among emerging market investors, suggesting a potential moderating role in the relationship between behavioral biases and investment outcomes. They also build upon the insights of Iram and Bilal [13], which documented how different dimensions of financial literacy influence susceptibility to cognitive biases among women entrepreneurs, suggesting potentially distinctive moderating effects for traditional and digital literacy dimensions.

2.3.6. Contextual Moderators

Based upon evidence regarding the importance of contextual factors in shaping investment behavior in emerging markets [1, 3], this research hypothesizes:

H_{6a}: Regulatory environment perceptions influence the relationship between digital finance adoption and investment decision quality.

H_{6b}: Digital infrastructure access influences the relationship between digital financial literacy and digital finance adoption.

These hypotheses build upon findings from Le et al. [3], which demonstrated how regulatory perceptions influenced digital finance adoption in emerging markets, and Nugraha et al. [22], which highlighted the role of infrastructure variations in shaping digital finance accessibility and usage patterns across different regions of emerging economies. They also extend the work of Kass-Hanna et al. [1], which documented the distinctive characteristics of emerging markets' regulatory approaches to digital finance and their implications for investor behavior.

2.3.7. Integrated Research Model

The hypothesized relationships are integrated into a comprehensive research model, as illustrated in Figure 1. This model conceptualizes investment decision quality in Vietnam as determined by the complex interplay between financial literacy (both general and digital), digital finance adoption, behavioral biases, and Vietnam-specific contextual factors, with important mediating and moderating pathways.

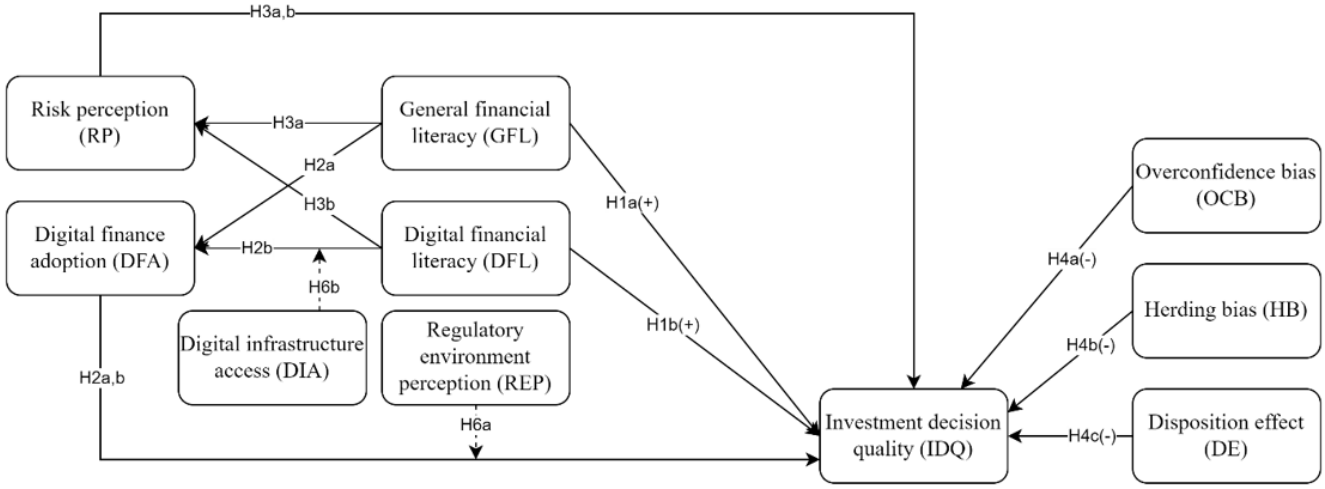

Figure 1.
Digital-Behavioral Investment Decision Framework for Vietnam.

The proposed model makes several important theoretical contributions. First, it integrates previously siloed constructs into a unified framework that captures their complex interactions within Vietnam's specific market context. Second, it distinguishes between general and digital financial literacy, recognizing the unique contribution of each to investment outcomes in Vietnam's rapidly digitalizing financial ecosystem. Third, it explicitly models the mediating roles of digital finance adoption and risk perception, advancing understanding of the mechanisms through which financial literacy influences investment decisions in Vietnam. Fourth, it incorporates key contextual factors specific to Vietnam, enhancing the contextual sensitivity and applicability of the framework. Finally, it examines how financial literacy moderates the impact of behavioral biases in Vietnam, providing insights into potential intervention strategies appropriate for this specific market environment.

3. Methodology

3.1. Methodological Integration Framework

This research employs a sophisticated methodological architecture that integrates advanced quantitative modelling techniques to investigate the Digital-Behavioral Investment Decision Framework within Vietnam's distinctive financial ecosystem. This methodological integration responds to calls for greater paradigmatic diversity in financial behavior research [11, 26] and represents a comprehensive approach to examining complex sociotechnical phenomena within emerging market contexts.

The quantitative dimension employs structural equation modeling with a stratified random sample of 452 Vietnamese retail investors who engaged in digital platform investment within the previous year. This methodological component enables the simultaneous examination of complex interdependent relationships, including direct effects, mediating mechanisms, and moderating influences. The SEM analysis is complemented by fuzzy-set Qualitative Comparative Analysis (fsQCA), identifying configurational pathways to investment success while acknowledging equifinality and conjunctural causation patterns that transcend variable-centered analytical frameworks. Multigroup analysis examines heterogeneous manifestations across demographic segments, including age cohorts (18-35/36+), gender groups, and geographical locations (urban/provincial).

The integration of these methodological approaches follows a concurrent triangulation design, where quantitative data were collected, analyzed, and then interpreted. This design enables a comprehensive exploration of the research questions and the development of a more nuanced understanding than a single approach could provide.

3.2. Contextualized Measurement Instrumentation

The study employed rigorously adapted measurement instruments, contextually calibrated for Vietnam's financial environment. The general financial literacy assessment utilized an expanded OECD/INFE scale with Vietnam-specific modifications across knowledge, behavior, and attitude dimensions. Digital financial literacy employed Morgan et al.'s Digital Financial Literacy Scale, adapted for Vietnam's specific technological context [3], encompassing digital financial knowledge, skills, security awareness, and responsibility dimensions.

Digital finance adoption was operationalized through three dimensions: (1) usage intensity (frequency and depth of digital financial platform use), (2) AI-assisted decision support acceptance (degree of engagement with algorithm-based recommendations), and (3) digital financial platform trust (confidence in platform security and reliability). These dimensions were measured using a 5-point Likert scale with context-specific item formulations.

Behavioral biases were measured using contextually adapted instruments. Overconfidence was assessed through comparative self-assessment measures (e.g., "Compared to other investors, my investment knowledge is above average") and objective-subjective knowledge calibration items. Herding was measured through items capturing the tendency to follow peers, online influencers, and market trends. The disposition effect was operationalized through scenario-based questions assessing willingness to hold losing investments and sell winning investments.

Investment decision quality was operationalized as a multidimensional construct encompassing: (1) Portfolio diversification (measured through assessment of actual asset allocation using Herfindahl-Hirschman Index calculations), (2) Risk-adjusted decision-making (measured through comparison of chosen investments with respondents' stated risk tolerance levels and financial goals), (3) Decision consistency (assessed through scenario-based questions evaluating application of consistent principles across different contexts), and (4) Subjective satisfaction (self-assessment of investment outcomes relative to expectations and goals). These components were aggregated into a composite measure using confirmatory factor analysis, with each dimension weighted according to its factor loading. This multidimensional operationalization provides a comprehensive assessment of investment decision quality that balances objective performance measures with subjective evaluations, acknowledging that quality encompasses both process and outcome dimensions.

Vietnam-specific contextual variables included regulatory environment perception (measured through items assessing perceived adequacy, fairness, and stability of financial regulations) and digital infrastructure access (assessed through measures of internet reliability, device quality, and service accessibility).

All instruments demonstrated robust psychometric properties (Cronbach's α: 0.83-0.94, composite reliability: >0.85, AVE: >0.50) following rigorous cultural adaptation through expert review, cognitive interviewing, and pilot testing with Vietnamese investors.

3.3. Multi-Method Analytical Architecture

The analytical framework employed a sophisticated multi-method approach following a two-step procedure for SEM implementation: first, validating measurement properties through confirmatory factor analysis; then, examining hypothesized relationships through path analysis with bootstrapping procedures (5,000 resamples) for mediation testing, latent moderated structural equations for interaction effects, and conditional process analysis for contextual influences.

For the fsQCA component, calibration of fuzzy sets was performed based on both theoretical and empirical considerations. For financial literacy dimensions (both general and digital), the crossover point (0.5 membership) was established at the scale midpoint, as this represents a theoretically meaningful threshold between low and high literacy. Full membership (1.0) was calibrated at the 90th percentile of the observed distribution, while full non-membership (0.0) was set at the 10th percentile. For behavioral biases, calibration followed similar principles, with crossover points at scale midpoints and distribution-based anchors for full membership and non-membership.

For investment decision quality, a more nuanced calibration approach was employed. The crossover point (0.5) was established at a level corresponding to achieving moderate diversification (HHI between 0.25-0.30), risk-return alignment within +/- 10% of optimal allocation given stated risk preferences, and subjective satisfaction ratings at scale midpoint. Full membership (1.0) was calibrated to represent excellent diversification (HHI < 0.15), optimal risk-return alignment, and high subjective satisfaction (top quintile). Full non-membership (0.0) was set at levels indicating poor diversification (HHI > 0.50), significant risk-return misalignment, and low subjective satisfaction (bottom quintile). This calibration approach ensures that the fuzzy-set analysis meaningfully captures the theoretical concepts under investigation, with thresholds that reflect substantively important distinctions in the Vietnamese context.

This methodological innovation represents a significant advancement over prior approaches to financial behavior research in emerging markets, which have frequently employed decontextualized frameworks with insufficient attention to cultural specificity, methodological pluralism, and the complex interplay between quantitative patterns within rapidly digitalizing financial ecosystems.

4. Results

4.1. Quantitative Findings

4.1.1. Measurement Model Results

The confirmatory factor analysis demonstrated strong psychometric properties for all constructs in the Vietnamese sample. As shown in Table 1, all constructs exhibited satisfactory reliability (Cronbach's α > 0.80, composite reliability > 0.85) and convergent validity (average variance extracted > 0.50). Discriminant validity was established through both the Fornell-Larcker criterion and the heterotrait-monotrait ratio, with all constructs showing adequate distinction.

Table 1.
Measurement Model Assessment.

Construct	Cronbach's α	Composite Reliability	AVE	Range of Standardized Loadings
GFL	0.87	0.90	0.63	0.71-0.88
DFL	0.92	0.94	0.69	0.76-0.93
DFA	0.88	0.91	0.64	0.70-0.89
RP	0.89	0.92	0.67	0.73-0.90
OCB	0.85	0.89	0.59	0.69-0.87
HB	0.83	0.88	0.63	0.72-0.86
DE	0.84	0.88	0.57	0.68-0.85
DIA	0.86	0.90	0.65	0.74-0.87
REP	0.91	0.93	0.68	0.75-0.91
IDQ	0.90	0.93	0.67	0.74-0.92

Note: GFL = General Financial Literacy; DFL = Digital Financial Literacy; DFA = Digital Finance Adoption; RP = Risk Perception; OCB = Overconfidence Bias; HB = Herding Bias; DE = Disposition Effect; DIA = Digital Infrastructure Access; REP = Regulatory Environment Perception; IDQ = Investment Decision Quality; AVE = Average Variance Extracted.

These findings confirm the validity and reliability of the measurement model within the Vietnamese context, providing a solid foundation for subsequent structural analyses. The strong psychometric properties across all constructs indicate that the adapted measurement instruments effectively capture the intended constructs in Vietnam's specific cultural and market environment.

4.1.2. Descriptive Statistics and Preliminary Analyses

Descriptive statistics revealed noteworthy patterns among Vietnamese investors. Digital financial literacy (M = 3.65, SD = 0.79) was higher than general financial literacy (M = 3.41, SD = 0.82), reflecting Vietnam's technological leapfrogging phenomenon, where digital adoption frequently precedes traditional financial knowledge development. Behavioral biases showed interesting patterns: overconfidence bias was moderate (M = 3.22, SD = 0.84), while herding tendencies were relatively high (M = 3.69, SD = 0.87), consistent with Vietnam's collectivist cultural orientation. The disposition effect also showed substantial presence (M = 3.53, SD = 0.86). Correlation analysis revealed significant relationships among key constructs in the Vietnamese sample. Both general financial literacy ($r = 0.41$, $p < 0.001$) and digital financial literacy ($r = 0.57$, $p < 0.001$) were positively correlated with investment decision quality, while behavioral

biases showed negative correlations (overconfidence: $r = -0.36$, $p < 0.001$; herding: $r = -0.44$, $p < 0.001$; disposition effect: $r = -0.38$, $p < 0.001$). Digital finance adoption was positively correlated with both general financial literacy ($r = 0.34$, $p < 0.001$) and digital financial literacy ($r = 0.56$, $p < 0.001$), supporting its potential mediating role. Notably, Vietnam-specific contextual variables showed significant correlations with several core constructs. Regulatory environment perceptions were positively correlated with digital finance adoption ($r = 0.39$, $p < 0.001$) and investment decision quality ($r = 0.32$, $p < 0.001$). Digital infrastructure access showed significant correlations with digital financial literacy ($r = 0.42$, $p < 0.001$) and digital finance adoption ($r = 0.47$, $p < 0.001$).

Regional comparisons revealed interesting patterns, with digital financial literacy significantly higher in urban centres ($M = 3.84$, $SD = 0.73$) compared to provincial areas ($M = 3.46$, $SD = 0.82$; $t(214) = 3.76$, $p < 0.001$). Digital finance adoption showed similar regional variations (urban: $M = 3.92$, $SD = 0.77$; provincial: $M = 3.37$, $SD = 0.91$; $t(214) = 4.12$, $p < 0.001$), reflecting infrastructure disparities across Vietnam's diverse geographical regions.

4.1.3. Structural Model Results

The structural model demonstrated a good fit to the data across multiple indices: $\chi^2/df = 2.37$, CFI = 0.95, TLI = 0.94, RMSEA = 0.039 [90% CI: 0.035, 0.043], SRMR = 0.037. Table 2 presents the path coefficients for the hypothesized direct relationships.

Table 2.
Path Coefficients for Direct Relationships.

Hypothesis	Path	Standardized Coefficient (β)	p-value	Support
H1a	GFL → IDQ	0.287	<0.001	Supported
H1b	DFL → IDQ	0.412	<0.001	Supported
H4a	OCB → IDQ	-0.279	<0.001	Supported
H4b	HB → IDQ	-0.364	<0.001	Supported
H4c	DE → IDQ	-0.268	<0.001	Supported

Note: GFL = General Financial Literacy; DFL = Digital Financial Literacy; OCB = Overconfidence Bias; HB = Herding Bias; DE = Disposition Effect; IDQ = Investment Decision Quality.

The findings support hypotheses H1a-b, confirming that both general and digital financial literacy positively influence investment decision quality among Vietnamese investors. The stronger effect of digital financial literacy ($\beta = 0.412$) compared to general financial literacy ($\beta = 0.287$) highlights the particularly important role of digital financial competencies in Vietnam's rapidly digitalizing financial ecosystem. Hypotheses H4a-c are also supported, with all three behavioral biases showing significant negative associations with investment decision quality in the Vietnamese context. The particularly strong negative effect of herding bias ($\beta = -0.364$) is consistent with Vietnam's collectivist cultural environment. The model explains a substantial portion of the variance in investment decision quality ($R^2 = 0.53$), indicating the strong explanatory power of the proposed framework within Vietnam's specific market context. This significant explained variance suggests that the integrated model effectively captures the key determinants of investment outcomes in Vietnam's emerging market environment.

4.1.4. Mediation Analysis Results

Bootstrapping procedures (5,000 resamples) were employed to test the hypothesized mediating effects of digital finance adoption (H2a-b) and risk perception (H3a-b). Table 3 presents the results of these analyses.

Table 3.
Mediation Analysis Results.

Hypothesis	Indirect Path	Standardized Indirect Effect	95% CI	Support
H2a	GFL → DFA → IDQ	0.158	[0.103, 0.213]	Supported
H2b	DFL → DFA → IDQ	0.241	[0.186, 0.296]	Supported
H3a	GFL → RP → IDQ	0.173	[0.119, 0.227]	Supported
H3b	DFL → RP → IDQ	0.232	[0.177, 0.287]	Supported

Note: GFL = General Financial Literacy; DFL = Digital Financial Literacy; DFA = Digital Finance Adoption; RP = Risk Perception; IDQ = Investment Decision Quality.

The analysis supports hypotheses H2a-b, confirming that digital finance adoption mediates the relationships between both dimensions of financial literacy and investment decision quality among Vietnamese investors. The stronger mediating effect for digital financial literacy (indirect effect = 0.241) compared to general financial literacy (indirect effect = 0.158) emphasizes the particularly important role of digital competencies in facilitating effective use of digital financial platforms in Vietnam. Hypotheses H3a-b are also supported, with risk perception serving as a significant mediator in the relationship between financial literacy dimensions and investment outcomes in Vietnam's emerging market context.

The mediating effects of digital finance adoption and risk perception explain a substantial portion of the total effect of financial literacy dimensions on investment decision quality (51.4% for general financial literacy, 53.8% for digital financial literacy), highlighting the importance of these mediating mechanisms in understanding how financial knowledge shapes investment outcomes in Vietnam's context.

4.1.5. Moderation Analysis Results

Latent moderated structural equations were used to test the hypothesized moderating effects of financial literacy dimensions on the relationships between behavioral biases and investment decision quality (H5a-f). Table 4 presents these results.

Table 4.
Moderation Effects of Financial Literacy on Bias-Investment Relationships.

Hypothesis	Interaction Term	Standardized Coefficient (β)	p-value	Support
H5a	GFL × OCB	0.183	<0.01	Supported
H5b	DFL × OCB	0.271	<0.001	Supported
H5c	GFL × HB	0.139	<0.05	Supported
H5d	DFL × HB	0.227	<0.01	Supported
H5e	GFL × DE	0.122	<0.05	Supported
H5f	DFL × DE	0.192	<0.01	Supported

Note: GFL = General Financial Literacy; DFL = Digital Financial Literacy; OCB = Overconfidence Bias; HB = Herding Bias; DE = Disposition Effect.

The findings support hypotheses H5a-f, demonstrating that both general and digital financial literacy moderate the negative relationships between behavioral biases and investment decision quality among Vietnamese investors. The stronger moderating effect of digital financial literacy (β = 0.271) compared to general financial literacy (β = 0.183) for overconfidence bias emphasizes the particularly important role of digital competencies in mitigating cognitive biases in Vietnam's digital investment environment. Similar patterns are observed for herding bias and disposition effect, suggesting that financial literacy broadly attenuates the negative impact of behavioral biases on investment decisions in the Vietnamese context.

The moderating effects of financial literacy dimensions explain a substantial portion of the variance in the relationship between behavioral biases and investment outcomes ($\Delta R^2 = 0.084$ for overconfidence bias, $\Delta R^2 = 0.073$ for herding bias, $\Delta R^2 = 0.061$ for disposition effect), highlighting the importance of financial knowledge in shaping how behavioral biases influence investment decisions in Vietnam's context.

4.1.6. Vietnam-Specific Contextual Factors

To test the hypothesized effects of Vietnam-specific contextual factors (H6a-b), interaction terms were created and tested within the structural model. Table 5 presents these results.

Table 5.
Effects of Vietnam-Specific Contextual Factors.

Hypothesis	Interaction Term	Standardized Coefficient (β)	p-value	Support
H6a	REP × DFA	0.326	<0.01	Supported
H6b	DIA × DFL	0.289	<0.01	Supported

Note: DFL = Digital Financial Literacy; DFA = Digital Finance Adoption; DIA = Digital Infrastructure Access; REP = Regulatory Environment Perception.

The findings support hypotheses H6a-b, confirming the importance of Vietnam-specific contextual factors in shaping investment behavior. Regulatory environment perceptions significantly influence the relationship between digital finance adoption and investment decision quality ($\beta = 0.326$, $p < 0.01$). The positive interaction effect indicates that the relationship between digital finance adoption and investment outcomes is stronger when regulatory perceptions are more favorable, suggesting that regulatory trust enhances the effectiveness of digital financial tools in improving investment decisions.

Digital infrastructure access significantly influences the relationship between digital financial literacy and digital finance adoption ($\beta = 0.289$, $p < 0.01$). The positive interaction effect indicates that the relationship between digital financial literacy and digital finance adoption is stronger in contexts with better digital infrastructure, highlighting the importance of technological enablers in translating digital financial knowledge into platform engagement.

These contextual interactions explain significant additional variance in the relationships between core constructs ($\Delta R^2 = 0.087$ for H6a, $\Delta R^2 = 0.073$ for H6b), underscoring the importance of considering Vietnam's specific environmental characteristics when examining the interplay between financial literacy, digital finance adoption, and investment outcomes.

Table 6.
Multigroup Analysis Results.

Path	Age Groups		Gender Groups		Location Groups	
	Younger	Older	Male	Female	Urban	Provincial
GFL → IDQ	0.243***	0.326***	0.271***	0.308***	0.294***	0.267**
DFL → IDQ	0.483***	0.327***	0.427***	0.392***	0.437***	0.321**
DFA → IDQ	0.312***	0.276***	0.294***	0.303***	0.328***	0.248**
OCB → IDQ	-0.267***	-0.293***	-0.312***	-0.243**	-0.284***	-0.257**
HB → IDQ	-0.384***	-0.329***	-0.342***	-0.397***	-0.356***	-0.392***
DE → IDQ	-0.253**	-0.287***	-0.274***	-0.261**	-0.271***	-0.257**
DFL × OCB	0.313***	0.214**	0.285***	0.243**	0.293***	0.196*

Note: GFL = General Financial Literacy; DFL = Digital Financial Literacy; DFA = Digital Finance Adoption; OCB = Overconfidence Bias; HB = Herding Bias; DE = Disposition Effect; IDQ = Investment Decision Quality; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2. Multigroup Analysis Results

To examine potential heterogeneity in the proposed relationships across different demographic segments, multigroup SEM analysis was conducted. Table 6 presents key results from this analysis, comparing path coefficients across age cohorts (younger: 18-35, n = 116; older: 36+, n = 100), gender groups (male, n = 120; female, n = 94), and location categories (urban, n = 173; provincial, n = 43). The multigroup analysis reveals significant heterogeneity in several key relationships across demographic segments. Notably, the effect of digital financial literacy on investment decision quality is substantially stronger for younger investors ($\beta = 0.483$) compared to older investors ($\beta = 0.327$), with the difference being statistically significant ($\Delta\chi^2 = 8.73$, $p < 0.01$). Conversely, the effect of general financial literacy is stronger for older investors ($\beta = 0.326$) compared to younger investors ($\beta = 0.243$), though this difference is less pronounced ($\Delta\chi^2 = 3.86$, $p < 0.05$). Gender differences are particularly notable in the relationship between herding bias and investment decision quality, with a stronger negative effect for female investors ($\beta = -0.397$) compared to male investors ($\beta = -0.342$), although the difference is marginally significant ($\Delta\chi^2 = 3.64$, $p = 0.056$). Location-based differences are evident in several relationships, with the effects of both digital financial literacy and digital finance adoption on investment decision quality being stronger in urban areas compared to provincial locations. These geographical variations align with the documentation of urban-rural disparities in digital financial service accessibility and effectiveness within Vietnam.

The moderating effect of digital financial literacy on the relationship between overconfidence bias and investment decision quality also shows significant demographic variation, being particularly strong among younger investors ($\beta = 0.313$) and in urban locations ($\beta = 0.293$). This heterogeneity suggests that the protective role of digital financial literacy against behavioral biases may be more pronounced in certain demographic segments.

4.3. fsQCA Results

Complementary fsQCA was conducted to identify configurational pathways to high-quality investment decisions in the Vietnamese context. Variables were calibrated into fuzzy sets using theoretical and empirical anchoring points, with full membership (1.0), crossover point (0.5), and full non-membership (0.0) thresholds established for each condition and the outcome. Table 7 presents the sufficient configurations that consistently lead to high-quality investment decisions, along with their consistency and coverage metrics.

Table 7.
fsQCA Results for High-Quality Investment Decisions.

Configuration	Conditions Present	Conditions Absent	Raw Coverage	Unique Coverage	Consistency
1	DFL, DFA, ~OCB, ~HB	-	0.37	0.12	0.92
2	GFL, REP, ~HB	~OCB	0.32	0.08	0.88
3	DFL, GFL, ~DE	~OCB, ~HB	0.30	0.07	0.86
4	DFL, DFA, REP	~OCB, ~HB, ~DE	0.28	0.06	0.89
5	GFL, DIA, RP	~OCB, ~HB, ~DE	0.25	0.05	0.87

Note: DFL = Digital Financial Literacy; GFL = General Financial Literacy; DFA = Digital Finance Adoption; OCB = Overconfidence Bias; HB = Herding Bias; DE = Disposition Effect; REP = Regulatory Environment Perceptions; DIA = Digital Infrastructure Access; RP = Risk Perception; ~ indicates absence of condition
Overall solution consistency: 0.89; Overall solution coverage: 0.73

The fsQCA results reveal multiple equifinal pathways to high-quality investment decisions in the Vietnamese context, indicating that different combinations of factors can lead to similar outcomes. The most empirically relevant configuration (Configuration 1: raw coverage = 0.37, consistency = 0.92) combines the presence of digital financial literacy and digital finance adoption with the absence of overconfidence and herding biases. This configuration aligns with the variable-centered findings regarding the importance of digital dimensions in Vietnam's rapidly digitalizing financial ecosystem.

Configuration 2 (raw coverage = 0.32, consistency = 0.88) represents an alternative pathway that combines traditional financial literacy with favorable regulatory perceptions and low herding tendencies, but without necessarily low overconfidence bias. This configuration suggests that strong regulatory trust can potentially compensate for certain behavioral biases in Vietnam's emerging market context, a nuanced insight not captured in the variable-centered SEM analysis. Configuration 3 (raw coverage = 0.30, consistency = 0.86) highlights the combined protective effect of both financial literacy dimensions against the disposition effect, whilst also showing low levels of other behavioral biases. This configuration suggests that comprehensive financial literacy across both traditional and digital domains may be particularly effective in mitigating certain biases in Vietnam's investment environment. Configurations 4 and 5 represent less common but still relevant pathways, highlighting the roles of regulatory perceptions, digital infrastructure, and risk perception in creating conditions conducive to high-quality investment decisions. The overall solution consistency (0.89) and coverage (0.73) indicate that these five configurations collectively explain a substantial portion of the cases with high-quality investment decisions in the Vietnamese sample. These configurational findings complement the variable-centered results by highlighting the concepts of equifinality and conjunctural causation in pathways to investment success among Vietnamese investors. The identification of multiple pathways suggests that different combinations of factors may lead to similar outcomes within Vietnam's specific market context, a complexity not fully captured in traditional regression-based approaches.

5. Discussion

5.1. Reconceptualizing Financial Literacy in Digitally Transforming Contexts

The findings necessitate a paradigmatic shift in the conceptualization of financial literacy for Vietnam's contemporary investment context. The significant impact of digital financial literacy on investment decision quality ($\beta = 0.412$, $p < 0.001$) empirically validates the theoretical distinction between traditional and digital financial literacy dimensions. This transcends conventional unidimensional conceptualizations [7, 8] by establishing the empirical distinctiveness of digital financial competencies as qualitatively different constructs with substantial independent contributions to investment outcomes. This reconceptualization acquires particular theoretical salience within Vietnam's technological leapfrogging phenomenon. The findings provide robust empirical validation for this observation, with digital financial literacy emerging as a particularly potent predictor of investment outcomes, especially among younger demographic cohorts. This aligns with Kass-Hanna et al. [1] documentation of similar patterns in other emerging markets experiencing rapid digital transformation. The strong correlation between digital finance adoption and digital financial literacy ($r = 0.56$, $p < 0.001$), coupled with digital finance adoption's significant mediating role in the literacy-investment relationship ($\beta = 0.241$, $p < 0.001$), suggests a dynamic relationship where technological engagement and financial knowledge continuously shape and transform each other. This advances theory by moving beyond linear conceptualizations toward more co-evolutionary frameworks. The multigroup findings regarding age-related heterogeneity further enrich this theoretical contribution. The substantially stronger effect of digital financial literacy among younger investors ($\beta = 0.483$ vs. $\beta = 0.327$ for older investors) extends the concept of generational digital divides by demonstrating that these divides manifest not merely as differences in literacy levels but as fundamental variations in how different literacy dimensions influence investment behavior across age cohorts.

5.2. New Perspectives on Behavioral Biases in Digital-Cultural Contexts

This research advances understanding of behavioral biases in digitally mediated investment environments. The persistence of significant negative relationships between behavioral biases and investment decision quality, even in Vietnam's highly digitalized context, challenges technological determinist perspectives that assume digital tools automatically reduce irrational behavior [3, 27]. Instead, the findings support a more nuanced view where digital interfaces may sometimes amplify rather than mitigate biases, particularly in culturally specific manifestations.

The particularly strong negative effect of herding bias on investment outcomes in Vietnam ($\beta = -0.364$, $p < 0.001$) provides empirical support for the proposition that Vietnam's collectivist cultural orientation intensifies social influence effects. This research extends prior work by quantifying this effect within a comprehensive model that accounts for multiple biases simultaneously, demonstrating herding bias's relative prominence compared to other biases in Vietnam's cultural context. The moderating effects of both general financial literacy ($\beta = 0.183$, $p < 0.01$) and digital financial literacy ($\beta = 0.271$, $p < 0.001$) on the relationship between overconfidence bias and investment outcomes suggest that context-specific knowledge is particularly important for bias mitigation in digital settings. This extends behavioral finance theory by demonstrating that debiasing mechanisms' effectiveness may vary significantly across different technological and cultural contexts. The stronger moderating effect of digital financial literacy represents a particularly novel finding, suggesting technological competencies may be especially valuable for recognizing and mitigating biases in digital environments.

The fsQCA findings complement these variable-centered insights by identifying multiple equifinal pathways to high-quality investment decisions. Configuration 1 (combining digital financial literacy and digital finance adoption with the absence of overconfidence and herding biases) emerged as the most empirically relevant pathway (coverage = 0.37, consistency = 0.92), highlighting how the absence of key biases works synergistically with digital competencies to enhance investment outcomes in Vietnam's digitally transforming context.

5.3. Integrating Context-Specific Factors into Behavioral Finance Models

This research advances behavioral finance theory by systematically integrating Vietnam-specific contextual factors into explanatory models. The significant effects of regulatory environment perceptions ($\beta = 0.326$, $p < 0.01$) and digital infrastructure access ($\beta = 0.289$, $p < 0.01$) empirically demonstrate that behavioral finance phenomena in Vietnam are significantly shaped by distinctive institutional and technological factors. This represents an important theoretical extension beyond traditional behavioral finance models that have often assumed contextual independence or treated contextual factors as control variables rather than integral theoretical components [11, 12]. The significant interaction between regulatory environment perceptions and digital finance adoption extends understanding of regulatory trust in Vietnam's hybrid regulatory environment by demonstrating how regulatory perceptions specifically moderate the relationship between digital tool usage and investment outcomes, rather than merely influencing adoption decisions. The significant interaction between digital infrastructure access and digital financial literacy demonstrates how infrastructure variations specifically moderate the relationship between knowledge structures and platform engagement. This more sophisticated conceptualization advances the theoretical understanding of how technological factors condition the relationship between financial knowledge and financial behavior in emerging markets with heterogeneous infrastructure development.

The fsQCA findings further enrich this contextual perspective by identifying multiple configurational pathways to investment success, including configurations incorporating Vietnam-specific contextual factors. Configuration 2, which combines traditional financial literacy with favorable regulatory perceptions and low herding tendencies (coverage = 0.32, consistency = 0.88), and Configuration 5, which integrates general financial literacy with digital infrastructure access and risk perception (coverage = 0.25, consistency = 0.87), suggest that contextual factors operate not merely as independent

variables or moderators but as integral components of complex causal configurations leading to successful investment outcomes.

6. Conclusion

6.1. Theoretical Contributions

This research makes several significant theoretical contributions to understanding investment behavior in digitally transforming emerging markets. First, it advances financial literacy conceptualization by empirically validating the distinctiveness of digital financial literacy as a qualitatively different construct from traditional financial literacy, with substantial independent contributions to investment outcomes. This reconceptualization is particularly salient in contexts experiencing technological leapfrogging, where digital competencies may develop before traditional financial knowledge. Second, the research enriches behavioral finance theory by documenting how behavioral biases manifest in culturally specific ways within digitally mediated environments. The finding that herding bias has particularly strong negative effects in Vietnam's collectivist cultural context, and that digital interfaces can amplify rather than mitigate this bias, challenges technological determinist perspectives and highlights the importance of cultural-technological interactions in shaping investment behavior. Third, this study advances understanding of how contextual factors fundamentally shape investment phenomena in emerging markets. By demonstrating significant moderating effects of regulatory environment perceptions and digital infrastructure access, the research establishes these contextual elements as integral components of theoretical models rather than mere background factors. The identification of multiple configurational pathways to investment success further highlights the complex, conjunctural nature of these contextual influences. Fourth, the research makes methodological contributions by demonstrating the value of mixed-methods approaches in financial behavior research. The integration of SEM and fsQCA provides a more comprehensive understanding than any single method could offer, capturing both general patterns and contextual nuances in a rapidly evolving financial landscape.

6.2. Practical Implications

This research offers several practical implications for various stakeholders in Vietnam's emerging market context. The epistemic trajectory reveals compelling evidence for demographically calibrated literacy interventions constructing traditional financial knowledge architectures upon extant digital competencies for younger cohorts, whilst facilitating technological fluency development for older investors with established financial knowledge foundations. The empirical findings regarding regulatory trust as a significant moderating variable necessitate transparent governance frameworks that enhance institutional legitimacy within digital finance ecosystems. This regulatory-adoption nexus suggests that adaptive policy instruments may substantially amplify financial inclusion trajectories through trust-mediated engagement pathways. For technological architects, the research illuminates ontological opportunities for platform design protocols that mitigate rather than amplify cognitive biases in their culturally-specific manifestations. The documented moderating effect of digital financial literacy on bias susceptibility strongly suggests implementation of embedded educational modalities within platform architectures to enhance users' metacognitive awareness of decision vulnerabilities.

6.3. Limitations and Future Research Directions

The present investigation, whilst methodologically robust, necessarily confronts epistemological boundaries that warrant acknowledgment. The cross-sectional data architecture constrains causal inference capabilities, suggesting that longitudinal research designs would more effectively capture the co-evolutionary dynamics between literacy structures, technological adoption patterns, and investment behaviors across temporal dimensions. The Vietnam-specific contextual embeddedness, whilst enabling depth of analysis, invites comparative cross-cultural investigations across diverse emerging market ecosystems to illuminate both nomothetic patterns and idiographic variations in literacy-adoption-bias interaction matrices. Furthermore, the behavioral bias taxonomy, whilst theoretically grounded, represents a necessarily constrained subset of cognitive predispositions that manifest within digitally-mediated investment environments. As financial technologies undergo transformative evolution through artificial intelligence integration and decentralized architectures, future scholarly trajectories must interrogate how these technological paradigm shifts reconfigure the complex interrelationships between literacy dimensions, behavioral predispositions, and investment outcomes within rapidly digitalizing emerging market contexts.

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