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Green Finance Literacy, Environmental Attitudes, and Sustainable Investment Behavior among Retail Investors in Emerging Economies: A Cross-National Structural Analysis

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Abstract

The global green finance market surpassed USD 1 trillion in annual issuance in 2023, yet retail investor participation in environmentally sustainable financial instruments remains disproportionately concentrated in high-income economies. Understanding the behavioral and attitudinal determinants of sustainable investment decisions among retail investors in emerging markets is therefore a matter of both academic and policy urgency. This study examines the influence of green finance literacy, environmental attitudes, and perceived green investment risk on sustainable investment behavior among retail investors in India, South Africa, and Vietnam. Drawing on the Theory of Planned Behavior and the Value-Belief-Norm framework, a conceptual model is developed and tested using partial least squares structural equation modeling (PLS-SEM) on data collected from 596 retail investors. The measurement model demonstrates satisfactory reliability and validity across all constructs. Results reveal that green finance literacy exerts the strongest direct effect on sustainable investment behavior (beta = 0.48, $p < 0.001$), followed by environmental attitude (beta = 0.34, $p < 0.001$) and subjective norms (beta = 0.27, $p < 0.01$). Perceived green investment risk exerts a significant negative effect (beta = -0.31, $p < 0.001$). Income level and prior investment experience positively moderate the literacy-behavior relationship. Country-level invariance testing confirms partial metric invariance, with India and South Africa showing stronger literacy effects than Vietnam. The findings advance the behavioral green finance literature and offer targeted implications for financial regulators, investment platforms, and sustainability-oriented investor education programs.

Keywords: - Green Finance Literacy, Sustainable Investment Behavior, Environmental Attitude, Theory Of Planned Behavior, Value-Belief-Norm Framework, PLS-SEM, Emerging Economies

I. INTRODUCTION

The urgency of redirecting global capital flows toward environmentally sustainable activities has moved from the margins of development discourse to the center of international financial governance. The Paris Agreement's commitment to limiting global warming to 1.5 degrees Celsius above pre-industrial levels requires annual sustainable investment flows estimated at USD 4 to 6 trillion globally through 2030, a figure that far exceeds the capacity of public finance alone (IPCC, 2023). Private capital mobilization, including the participation of retail investors in green bonds, sustainability-linked equities, environmental, social, and governance (ESG) funds, and green deposits, is therefore an essential component of any credible climate finance strategy (Kaminker & Stewart, 2012).

The green finance market has grown at a remarkable pace since the issuance of the first labeled green bond by the European Investment Bank in 2007, reaching cumulative issuance exceeding USD 3.5 trillion by the end of 2023 (Climate Bonds Initiative, 2024). Despite this growth, the investor base for green financial instruments remains heavily concentrated among institutional investors in advanced economies, with retail investor participation in emerging markets remaining limited

and poorly understood (Schoenmaker & Schramade, 2019). This concentration is both an equity concern and a systemic limitation on the scalability of green finance mobilization.

Emerging market economies represent a particularly critical domain for green finance retail participation for three interconnected reasons. First, they account for approximately two thirds of global greenhouse gas emissions and face the most acute adaptation and mitigation financing needs (IPCC, 2023). Second, their rapidly expanding middle classes represent a growing reservoir of investable household savings that could be channeled toward sustainable instruments given appropriate awareness, access, and incentive structures. Third, their financial regulatory and investment education ecosystems are actively evolving, creating windows for deliberate policy intervention to shape retail investor behavior in sustainability-aligned directions (Soundarrajan & Vivek, 2016).

However, the behavioral determinants of sustainable investment decisions among retail investors in emerging markets remain incompletely theorized and empirically underexplored. The established behavioral finance and environmental psychology literatures, developed primarily in North American and European contexts, may not translate straightforwardly to emerging market settings characterized by different levels of financial literacy, distinct cultural relationships with environmental stewardship, and varying institutional trust environments (Nguyen et al., 2020). Cross-national comparative studies that test the generalizability of behavioral models across heterogeneous emerging market contexts are a notable gap in the existing literature.

This study addresses that gap through three research questions:

- To what extent do green finance literacy, environmental attitudes, and perceived green investment risk predict sustainable investment behavior among retail investors in India, South Africa, and Vietnam?
- What role do subjective norms and personal environmental norms play in this behavioral model?
- Do income level and prior investment experience moderate the relationships between literacy, attitude, and sustainable investment behavior?

The remainder of the paper is organized as follows. Section 2 develops the theoretical framework and reviews the empirical literature. Section 3 describes the research methodology. Section 4 presents the findings. Section 5 discusses the theoretical and policy implications. Section 6 concludes with limitations and future research directions.

II. LITERATURE REVIEW

2.1. Theoretical Foundations

This study integrates two complementary theoretical frameworks. The Theory of Planned Behavior (TPB), developed by Ajzen (1991), posits that behavioral intentions, and through them actual behavior, are determined by three antecedents: attitude toward the behavior, subjective norms (perceived social pressure), and perceived behavioral control (confidence in one's ability to perform the behavior). TPB has been widely applied to financial decision-making, with robust support for the attitude and subjective norm pathways in predicting investment intentions across diverse cultural contexts (Gopi & Ramayah, 2007). In the sustainable investment domain, TPB provides a parsimonious structure for capturing the attitudinal and social dimensions of individual investor decision-making.

The Value-Belief-Norm (VBN) framework, proposed by Stern (2000) and extending Schwartz's (1977) norm activation theory, provides a complementary perspective specifically suited to pro-environmental behavior. VBN posits a causal chain from environmental values through ecological worldview beliefs and adverse consequence awareness to personal moral norms, which in turn predict pro-environmental behaviors. Applied to investment contexts, VBN suggests that sustainable investment behavior is not merely a financial decision but a value-expressive act grounded in environmental identity and moral obligation. The integration of TPB and VBN into a unified model captures both the rational-calculative and value-normative dimensions of sustainable investment decisions, following the approach of Han (2015) in the green consumption literature.

2.2. Green Finance Literacy and Investment Behavior

Financial literacy, defined broadly as the ability to understand and apply financial concepts to personal financial management, has long been identified as a significant predictor of investment behavior (Lusardi & Mitchell, 2014). The concept of green finance literacy extends this foundation to encompass knowledge of environmentally sustainable financial instruments, ESG rating methodologies, green bond frameworks, and the financial materiality of climate-related risks (Schoenmaker & Schramade, 2019). Empirical research specifically examining green finance literacy as a predictor of sustainable investment behavior is nascent but growing.

Riedl and Smeets (2017) demonstrated, using a large sample of Dutch retail investors, that investors with stronger sustainability preferences were more willing to accept lower financial returns for ESG-aligned portfolios, and that this preference was significantly stronger among investors with higher general financial sophistication. Extending this finding, Bauer et al. (2021) showed that participants in a randomized financial literacy intervention were significantly more likely to allocate portfolio shares to sustainable funds, suggesting that literacy enhancement causally affects sustainable allocation decisions. Soundarrajan and Vivek (2016) found analogous patterns in India, where financially literate retail investors were more likely to express interest in green mutual funds, though actual uptake remained constrained by product availability and trust concerns.

2.3. Environmental Attitudes and Perceived Risk

Environmental attitudes, reflecting the degree to which individuals evaluate environmental protection positively and feel personally responsible for environmental outcomes, are well-established predictors of pro-environmental behavior in the psychology literature (Stern, 2000). In the investment context, the translation of environmental attitudes into financial behavior

involves an additional cognitive step: recognizing that investment decisions constitute an environmental action with real-world ecological consequences. Jansson and Biel (2011) found that this moral linking, the explicit cognitive connection between financial portfolio choices and environmental impact, was the strongest single predictor of sustainable fund selection among Swedish retail investors.

Perceived green investment risk presents a theoretically important counterforce to attitude-driven sustainable investment. Retail investors in emerging markets frequently associate green financial instruments with lower liquidity, higher fees, greenwashing uncertainty, and unfamiliar risk-return profiles (Mercer, 2019). Lins et al. (2017) demonstrated that high-CSR firms outperformed low-CSR firms during the global financial crisis, suggesting that the perceived risk premium associated with sustainable instruments may be overstated. Nevertheless, investor perception rather than objective performance fundamentals governs retail allocation decisions in the short to medium term, making perceived risk a critical behavioral variable.

2.4. Subjective Norms and Social Influence

Subjective norms have received growing attention in the sustainable finance literature as peer networks, social media, and institutional endorsements increasingly shape retail investor awareness of and attitudes toward green instruments. Riedl and Smeets (2017) found that social identity with environmental organizations predicted sustainable portfolio allocation beyond individual attitude measures alone. More recently, Phan et al. (2020) documented that social influence from peers and family members was a significant predictor of green investment intention among young Vietnamese investors, with effect sizes comparable to those of individual financial attitude measures, suggesting that subjective norms may carry particularly strong weight in collectivist cultural contexts.

2.5. Research Gaps

Despite the growing literature on sustainable investment behavior, four significant gaps remain. First, most empirical studies focus on a single country and predominantly on European or North American samples, severely limiting cross-cultural generalizability. Second, green finance literacy as a distinct construct, separate from general financial literacy, has been inadequately operationalized and rarely validated across multiple countries simultaneously. Third, the moderating roles of income level and investment experience in the literacy-behavior relationship have not been tested in emerging market contexts. Fourth, the relative predictive weights of TPB and VBN constructs in a jointly specified model have not been empirically compared, leaving unresolved whether rational-calculative or value-normative pathways dominate sustainable investment decisions in emerging markets.

III. RESEARCH METHODOLOGY

3.1. Research Design

A cross-sectional quantitative survey design was employed, supplemented by a small qualitative validation component involving cognitive interviews to assess scale comprehension across the three national contexts. The primary analytical method was partial least squares structural equation modeling (PLS-SEM), selected for its suitability for theory development contexts where constructs include both reflective and formative measurement components, its robustness to non-normal data distributions common in attitudinal research, and its superior statistical power relative to covariance-based SEM for samples of moderate size (Hair et al., 2022). The comparative analysis across countries was conducted using multi-group analysis (MGA) within the PLS-SEM framework.

3.2. Research Objectives

The study was guided by the following specific research objectives:
Objective 1: To develop and validate a green finance literacy scale suitable for cross-national use among retail investors in India, South Africa, and Vietnam.
Objective 2: To test the direct effects of green finance literacy, environmental attitude, subjective norms, personal environmental norms, and perceived green investment risk on sustainable investment behavior.
Objective 3: To examine the moderating effects of income level and prior investment experience on the green finance literacy-behavior relationship.
Objective 4: To assess the cross-national invariance of the structural model using PLS-MGA.

3.3. Hypotheses

The following hypotheses were formulated on the basis of the theoretical framework and empirical literature:

- H1: Green finance literacy has a significant positive effect on sustainable investment behavior.
- H2: Environmental attitude has a significant positive effect on sustainable investment behavior.
- H3: Subjective norms have a significant positive effect on sustainable investment behavior.
- H4: Personal environmental norms have a significant positive effect on sustainable investment behavior.
- H5: Perceived green investment risk has a significant negative effect on sustainable investment behavior.
- H6: Income level positively moderates the relationship between green finance literacy and sustainable investment behavior.
- H7: Prior investment experience positively moderates the relationship between green finance literacy and sustainable investment behavior.

3.4. Sampling and Data Collection

The target population comprised adult retail investors aged 18 years and above who had made at least one investment in any financial instrument (savings deposits, equities, mutual funds, bonds, or insurance-linked products) within the preceding 24 months. Three countries were selected to represent distinct sustainability regulatory environments, ESG market development stages, and cultural orientations toward environmental stewardship: India (large, rapidly growing retail investor base with an emerging ESG fund market regulated by the Securities and Exchange Board of India), South Africa (the most advanced ESG disclosure and reporting framework in Sub-Saharan Africa under the Johannesburg Stock Exchange Sustainability Disclosure Guidance), and Vietnam (a frontier market with nascent ESG infrastructure and high environmental vulnerability to climate change).

Stratified quota sampling was employed, with strata defined by country, age group (18 to 35, 36 to 55, above 55), gender, and investment experience (below 3 years, 3 to 10 years, above 10 years). Survey administration was conducted online through established investor panel providers in each country, with quality controls including attention check items, response time filtering, and duplicate IP address exclusion. A total of 596 valid questionnaires were retained after data cleaning: 204 from India, 198 from South Africa, and 194 from Vietnam. A sample size adequacy analysis using the inverse square root method recommended by Kock and Hadaya (2018) confirmed that the sample was sufficient for detecting medium effect sizes at a statistical power of 0.80.

3.5. Measures and Instruments

The survey instrument comprised seven sections. Green finance literacy was measured using a newly developed 10-item scale covering knowledge of green bond principles, ESG rating methodologies, climate-related financial risk concepts, and green regulatory frameworks. Item development followed a systematic literature review, expert panel review involving six academics and three industry practitioners, and cognitive interview validation with 18 retail investors across the three countries. The scale demonstrated satisfactory content validity ratio (CVR = 0.83) and item discrimination indices across all national samples.

Environmental attitude was assessed using six items adapted from Dunlap et al. (2000), capturing both affective and cognitive dimensions of pro-environmental orientation. Subjective norms were measured using four items adapted from Ajzen (1991) for the investment context, capturing perceived social pressure from peers, family, and institutional sources. Personal environmental norms were measured using five items derived from Stern (2000), capturing felt moral obligation to make environmentally responsible investment choices. Perceived green investment risk was measured using five items adapted from Mercer (2019), covering liquidity risk, greenwashing risk, performance uncertainty, and regulatory risk. Sustainable investment behavior was assessed using a six-item behavioral frequency and intensity scale capturing actual allocations to green financial instruments in the preceding 12 months, supplemented by behavioral intention items for the subsequent 12 months.

All attitudinal items were anchored on seven-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree) to maximize response variance. Income level was operationalized as a six-category ordinal variable and prior investment experience as a continuous variable in years. A pilot study of 78 respondents confirmed Cronbach's alpha values ranging from 0.76 to 0.91 across all reflective constructs.

3.6. Analytical Strategy

PLS-SEM was executed using SmartPLS 4 software. The measurement model was assessed for all reflective constructs by examining indicator loadings (threshold greater than 0.70), internal consistency reliability (composite reliability greater than 0.70), convergent validity (average variance extracted, AVE greater than 0.50), and discriminant validity using the heterotrait-monotrait ratio of correlations (HTMT less than 0.85) recommended by Henseler et al. (2015). The structural model was evaluated using bootstrapping with 10,000 subsamples to generate confidence intervals for path coefficients and effect sizes (f-squared). Moderation was tested by incorporating product indicator interaction terms for income level and investment experience with green finance literacy. The predictive relevance of the model was assessed using the PLS predict procedure (Shmueli et al., 2019).

Cross-national measurement invariance was assessed following the permutation-based PLS-MGA procedure recommended by Ringle et al. (2020), testing configural, compositional, and full measurement invariance sequentially before proceeding to structural comparison across country groups. Post-hoc cluster analysis using k-means clustering was conducted to identify latent investor typologies based on green finance literacy and environmental attitude profiles, enabling a more granular examination of behavioral heterogeneity within the overall sample.

IV. RESULTS

4.1. Respondent Profile

The final sample had a mean age of 38.4 years (SD = 11.2). Female respondents constituted 44.3% of the sample, with the lowest female representation in Vietnam (39.2%) and highest in South Africa (49.0%). Educational attainment was high, with 72.1% holding at least a bachelor's degree, consistent with the online sampling frame and the educational profile of active retail investors in each country. Mean investment experience was 7.3 years (SD = 5.8). Sustainable instrument ownership at the time of survey was reported by 31.4% of respondents overall, ranging from 38.2% in India to 28.9% in Vietnam.

4.2. Measurement Model Assessment

All indicator loadings exceeded 0.70, ranging from 0.71 to 0.89 across the full pooled sample. Composite reliability values ranged from 0.82 to 0.93, and AVE values ranged from 0.52 to 0.71, confirming convergent validity for all constructs. HTMT ratios for all construct pairs were below 0.85, satisfying the discriminant validity criterion. The newly developed green finance literacy scale demonstrated particularly strong psychometric properties in the full sample (composite reliability = 0.91, AVE = 0.63), and cognitive interview data confirmed that items were semantically equivalent and comprehensible across all three national contexts. PLS predict analysis indicated that the model produced out-of-sample predictions superior to the most naïve benchmark for all endogenous constructs, confirming predictive relevance.

4.3. Structural Model Results and Hypothesis Testing

The structural model explained 58.4% of the variance in sustainable investment behavior (R-squared = 0.584), indicating strong explanatory power. Green finance literacy exerted the largest direct effect (beta = 0.48, t = 9.34, $p < 0.001$, f-squared = 0.31, indicating a large effect), supporting H1. Environmental attitude demonstrated a significant positive effect (beta = 0.34, t = 6.87, $p < 0.001$, f-squared = 0.17), supporting H2. Subjective norms showed a significant positive effect (beta = 0.27, t = 4.52, $p < 0.01$, f-squared = 0.09), supporting H3. Personal environmental norms had a positive effect that approached but did not reach conventional significance (beta = 0.14, t = 1.89, p = 0.059), providing only marginal support for H4. Perceived green investment risk exerted a significant negative effect (beta = -0.31, t = 5.76, $p < 0.001$, f-squared = 0.13), supporting H5.

Moderation analysis confirmed that income level significantly strengthened the positive effect of green finance literacy on sustainable investment behavior (interaction beta = 0.19, t = 3.12, $p < 0.01$), supporting H6. Prior investment experience also positively moderated the literacy-behavior relationship (interaction beta = 0.22, t = 3.67, $p < 0.001$), supporting H7. Slope analysis revealed that the literacy effect was negligible among investors with less than two years of experience and below-median income, but increased substantially among more experienced and higher-income investors, suggesting a threshold dynamic rather than a linear moderation pattern.

4.4. Cross-National Multi-Group Analysis

Permutation-based PLS-MGA confirmed configural and compositional invariance across all three country groups, enabling meaningful structural comparison. Full measurement invariance was supported for four of seven constructs; partial invariance was accepted for the remaining three following established guidelines (Ringle et al., 2020). Structural MGA revealed that the effect of green finance literacy on sustainable investment behavior was significantly larger in India (beta = 0.54) and South Africa (beta = 0.51) than in Vietnam (beta = 0.38), with pairwise MGA p-values of 0.032 and 0.041 respectively for the India-Vietnam and South Africa-Vietnam comparisons. The subjective norms effect was significantly stronger in Vietnam (beta = 0.41) than in India (beta = 0.21) or South Africa (beta = 0.23), consistent with the stronger social influence mechanisms hypothesized in more collectivist cultural contexts.

4.5. Investor Typology Cluster Analysis

K-means cluster analysis with k = 3 identified three distinct investor typologies. The Informed Advocates cluster (28.4% of the sample) exhibited high green finance literacy and strong environmental attitudes, and demonstrated the highest sustainable investment behavior scores and the lowest perceived risk scores. The Willing but Uncertain cluster (41.6%) showed moderate environmental attitudes but low green finance literacy, and reported high sustainable investment intentions that did not convert to actual allocation behavior, with perceived greenwashing risk as the most frequently cited barrier. The Disengaged cluster (30.0%) displayed low environmental attitudes, very low green finance literacy, and minimal sustainable investment behavior. Disengaged investors were significantly more likely to be located in Vietnam and to have below-median investment experience, providing a behavioral foundation for the structural MGA findings.

V. DISCUSSION

The findings of this study make four principal contributions to the behavioral green finance literature. First, the primacy of green finance literacy as a predictor of sustainable investment behavior (H1 supported, beta = 0.48, f-squared = 0.31) provides the most direct and cross-nationally validated evidence to date that domain-specific financial literacy, rather than generic financial knowledge, drives sustainable allocation decisions among retail investors. This finding extends Lusardi and Mitchell (2014) by demonstrating that investment behavior in specialized instrument categories requires specialized rather than general literacy inputs, with direct implications for the design of investor education programs.

Second, the significant negative effect of perceived green investment risk (H5 supported, beta = -0.31) confirms that investor misperceptions, particularly around greenwashing and liquidity, constitute a material behavioral barrier that attitudinal and social norm variables cannot overcome independently. The Willing but Uncertain investor typology is particularly instructive in this regard: investors in this cluster express favorable environmental attitudes and strong intentions but fail to convert them into actual sustainable allocations, with perceived risk as the decisive intervening factor. This finding has direct implications for product disclosure standards and investor communication strategies at financial institutions.

Third, the cross-national variation in the literacy and subjective norm pathways offers novel insights into the cultural contingency of sustainable investment behavior models. The stronger subjective norm effect in Vietnam compared to India and South Africa is consistent with cross-cultural psychology research documenting higher collectivism scores and stronger social conformity pressures in Vietnamese commercial contexts (Hofstede et al., 2010). The stronger literacy effect in India and South Africa may reflect the more developed retail investor education infrastructure and ESG media discourse in those two countries, which amplify the behavioral return to green finance knowledge. These findings caution against the application of homogenized behavioral intervention models across culturally diverse emerging market contexts.

Fourth, the moderation finding that the literacy-behavior relationship is most pronounced among higher-income and more experienced investors suggests a path dependency in the development of sustainable retail investor markets. Early-stage

markets may require income growth and investment experience accumulation as necessary preconditions for literacy enhancement programs to generate proportionate behavioral returns. This has implications for the sequencing of financial inclusion and green finance promotion policies, suggesting that sustainable investment mobilization should be approached as a long-term ecosystem development challenge rather than a short-term communication campaign.

VI. CONCLUSION

This study provides theoretically grounded and empirically rigorous cross-national evidence that green finance literacy is the primary behavioral determinant of sustainable investment among retail investors in emerging economies, operating alongside environmental attitudes and subject to important countervailing pressures from perceived green investment risk. The integrated TPB-VBN model explains 58.4% of the variance in sustainable investment behavior, a result that compares favorably with single-framework applications in the prior literature and validates the theoretical value of model integration.

For financial regulators, the findings argue for mandatory green finance literacy standards in investor suitability assessments for ESG instrument distribution, alongside robust anti-greenwashing disclosure requirements that directly address the perceived risk barriers documented among the Willing but Uncertain investor segment. The Securities and Exchange Board of India, the Financial Sector Conduct Authority of South Africa, and the State Securities Commission of Vietnam each have regulatory mandates and institutional capacity to implement targeted literacy and disclosure interventions aligned with these findings.

For investment platforms and financial institutions, the investor typology analysis suggests the value of segmented communication strategies. Informed Advocates can be deepened through sophisticated ESG performance reporting and portfolio impact measurement tools. Willing but Uncertain investors require transparent, standardized greenwashing risk disclosures and simplified ESG rating explanations to overcome the knowledge-intention gap. Disengaged investors require foundational literacy interventions before product-level sustainable investment promotion is likely to be effective.

For academic researchers, the validated green finance literacy scale developed in this study provides a psychometrically sound and cross-culturally robust instrument for future research. Its deployment in longitudinal panel studies tracking the co-evolution of literacy and sustainable investment behavior over time, and in experimental designs evaluating the causal effects of specific literacy interventions, would substantially advance the evidential foundation for policy and practice in this domain.

The study carries several limitations. The cross-sectional design precludes causal inference regarding the literacy-behavior relationship, and the online sampling frame may oversample digitally active, higher-educated investors relative to the general retail investor population. The behavioral measure relies partly on self-reported investment activity, which may be subject to social desirability bias in the direction of overstating sustainable allocations. Future research should employ administrative transaction data to validate self-reported sustainable investment behavior, extend the analysis to Latin American and Middle Eastern emerging markets, and investigate the role of fintech platform design in mediating the green finance literacy-behavior relationship.

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