PREFACE TO THE EDITION

The forthcoming issue of the **International Journal of Commerce and Management Research Studies (IJCMRS)** presents a diverse collection of scholarly contributions that examine emerging transformations in global commerce, financial systems, consumer behavior, and management practices. The articles included in this issue collectively emphasize the growing influence of digital technologies, sustainability considerations, and evolving institutional frameworks shaping contemporary business environments across developing and emerging economies.

A central theme across several contributions is the transformative role of digital innovation in enhancing economic participation and operational efficiency. One study investigates the impact of digital payment systems on financial inclusion among small and medium enterprises, highlighting improvements in credit access, banking relationships, and financial resilience. Another article explores the influence of e-commerce adoption on revenue growth among women-owned micro-enterprises in Sub-Saharan Africa, underscoring the role of digital platforms in expanding market reach and empowering underserved entrepreneurs. Additionally, research on blockchain technology adoption in trade finance provides empirical evidence on its capacity to reduce transaction processing time, minimize discrepancies, and strengthen inter-firm trust in cross-border trade environments.

Sustainability and responsible financial behavior also receive significant attention in this issue. A cross-national structural analysis examines the relationship between green finance literacy, environmental attitudes, and sustainable investment behavior among retail investors, revealing that knowledge and awareness significantly influence environmentally responsible investment decisions. These findings contribute to the broader discourse on promoting sustainable finance practices in emerging markets and provide valuable insights for policymakers and financial educators.

Consumer behavior in digitally mediated marketplaces is another focal area. One article investigates the interplay between influencer credibility, brand trust, and impulsive purchase intention in social commerce environments, with a comparative perspective across generational cohorts. The findings illuminate the mediating role of trust and the moderating influence of parasocial relationships, offering practical implications for marketers and platform operators.

Operational efficiency and financial performance in enterprise contexts are further explored through studies on supply chain finance adoption among manufacturing SMEs and its effects on working capital management and profitability. These findings highlight how financial innovations can optimize liquidity and strengthen buyer-supplier relationships. Complementing this, another study examines tax compliance behavior among gig economy workers, emphasizing the importance of tax morale, institutional trust, and digital tax administration in improving voluntary compliance in rapidly expanding informal digital labor markets.

Collectively, the articles in this issue reflect the interdisciplinary and global orientation of IJCMRS. They address contemporary challenges and opportunities in commerce and management through rigorous empirical methodologies, cross-country comparisons, and policy-relevant insights. The contributions not only advance academic discourse but also offer actionable recommendations for practitioners, policymakers, and industry stakeholders navigating an increasingly digitized and interconnected economic landscape.

The editorial team expresses sincere appreciation to the authors for their valuable contributions and to the reviewers for their thoughtful evaluations. It is hoped that this issue will stimulate further research and dialogue in the evolving domains of commerce and management studies and serve as a meaningful resource for scholars and professionals alike.

Dr. M M Bagali
Chief editor

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The Impact of Digital Payment Systems on Financial Inclusion: Evidence from Small and Medium Enterprises in Developing Economies

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Abstract

The rapid proliferation of digital payment systems has fundamentally altered the financial landscape of developing economies, offering novel pathways to financial inclusion for previously underserved populations. This study examines the relationship between digital payment adoption among small and medium enterprises (SMEs) and their access to formal financial services in India, Kenya, and Vietnam. Employing a mixed-methods research design, the study gathered quantitative data from 432 SME owners through structured questionnaires and qualitative insights from 24 in-depth interviews. Structural equation modeling (SEM) and thematic analysis were used to analyze the data. Findings reveal that digital payment adoption significantly improves SMEs' credit access (beta = 0.61, $p < 0.001$), banking relationships (beta = 0.47, $p < 0.01$), and overall financial resilience. Regulatory environment and digital literacy were found to be significant moderating variables. The study contributes to financial inclusion discourse by providing cross-country empirical evidence and practical recommendations for policymakers, fintech providers, and financial institutions.

Keywords: - Digital Payments, Financial Inclusion, Smes, Developing Economies, Fintech, Structural Equation Modeling

I. INTRODUCTION

Financial inclusion, defined as the availability and equality of opportunities to access financial services, has been a central concern for economists, policymakers, and development practitioners for several decades (World Bank, 2022). Despite significant progress, approximately 1.4 billion adults globally remain unbanked, with a disproportionate concentration in developing economies of Sub-Saharan Africa, South Asia, and Southeast Asia (Demirguc-Kunt et al., 2022). Small and medium enterprises operating in these contexts frequently encounter what Stiglitz and Weiss (1981) described as credit rationing, a systemic inability to access formal credit regardless of willingness to pay prevailing interest rates.

The emergence of mobile money platforms, digital wallets, and payment gateways has catalyzed a transformation in the financial services sector. Mobile-based payment systems such as M-Pesa in Kenya, PhonePe in India, and MoMo in Vietnam have dramatically expanded the financial frontier for populations historically excluded from conventional banking (Jack & Suri, 2011; Thakur & Srivastava, 2015). These platforms generate rich transactional data that serve as proxy indicators of creditworthiness, enabling formal financial institutions and fintech lenders to extend services to previously opaque borrowers.

However, the scholarly literature presents an incomplete picture. While macro-level studies confirm a positive association between digital financial infrastructure and national-level inclusion metrics, micro-level evidence on how individual SME-level digital payment adoption translates into tangible improvements in financial access remains scarce (Ozili, 2018). Furthermore, most existing studies focus on a single country, limiting the generalizability of findings. Cross-country comparative analyses that account for heterogeneous regulatory environments and cultural contexts are notably absent from the literature.

This study addresses these gaps by investigating the following research questions:

- To what extent does digital payment adoption influence credit access among SMEs in India, Kenya, and Vietnam?

- What role do digital literacy and regulatory environment play in moderating this relationship?
- How do SME operators perceive the benefits and barriers associated with transitioning from cash-based to digital payment systems?

The remainder of this paper is structured as follows. Section 2 presents a comprehensive review of the relevant literature. Section 3 outlines the research methodology. Section 4 reports the empirical findings. Section 5 discusses the implications of the findings, and Section 6 concludes with policy recommendations and directions for future research.

II. LITERATURE REVIEW

2.1. Financial Inclusion and SME Development

The nexus between financial inclusion and economic development has been extensively explored in the literature. Beck et al. (2007) demonstrated that financial deepening is positively associated with firm-level investment and employment growth, particularly for small enterprises. Building on this, Levine (2005) provided a comprehensive review establishing that financial intermediation accelerates productivity growth by facilitating risk diversification and capital allocation. These foundational contributions established the theoretical basis for prioritizing financial inclusion as a development objective.

SMEs constitute between 90 and 95 percent of all registered businesses in most developing economies and account for a substantial proportion of GDP and formal employment (IFC, 2020). Nevertheless, the SME financing gap in developing countries is estimated at approximately USD 5.2 trillion annually, representing a persistent structural impediment to growth (IFC, 2020). Ayyagari et al. (2021) attributed this gap to information asymmetries, weak collateral frameworks, and high transaction costs that characterize lending to small firms.

2.2. Digital Payment Systems and Financial Access

The theoretical underpinning for linking digital payments to financial inclusion draws primarily from information economics. Digital transactional footprints reduce information asymmetries between lenders and borrowers by enabling the creation of alternative credit scores based on payment frequency, volume, and consistency (Claessens et al., 2018). This mechanism has been empirically validated in several contexts. Jack and Suri (2011) found that mobile money adoption in Kenya was associated with significant improvements in household risk management and consumption smoothing, while Munyegera and Matsumoto (2016) documented similar effects in Uganda.

More recent scholarship has focused specifically on SME-level outcomes. Gutierrez-Nieto et al. (2023) analyzed panel data from 28 emerging market economies and found that fintech credit penetration was inversely correlated with SME financing gaps, after controlling for macroeconomic fundamentals. Ozili (2020) provided a nuanced critique, cautioning that digital financial inclusion does not automatically translate into better financial outcomes in the absence of appropriate regulatory safeguards and consumer protection mechanisms.

2.3. Moderating Factors: Digital Literacy and Regulatory Environment

Digital literacy, broadly defined as the ability to find, evaluate, and communicate information through digital technologies, has emerged as a critical determinant of the extent to which digital financial services generate inclusive outcomes (Lusardi & Mitchell, 2014). Van Dijk (2020) conceptualized digital inequality as a multi-layered phenomenon encompassing motivational, physical, skills-based, and usage access gaps. Applied to financial services, this framework suggests that even when digital payment infrastructure is available, usage barriers rooted in limited financial or digital literacy may prevent SMEs from fully leveraging available tools.

The regulatory environment represents another important contingency. Consistent with the enabling environment hypothesis advanced by Claessens et al. (2018), regulatory frameworks that balance innovation with consumer protection tend to foster more robust and equitable fintech ecosystems. Comparative studies by Sahay et al. (2020) confirmed that countries with proportionate, risk-based regulation achieved higher rates of digital financial inclusion without a commensurate increase in systemic risk.

2.4. Research Gaps

Despite this growing body of literature, several important gaps remain. First, most empirical studies rely on household-level or aggregate country-level data, neglecting enterprise-level dynamics. Second, cross-country studies employing consistent methodological frameworks and comparable samples are rare. Third, qualitative perspectives that illuminate the mechanisms and contextual factors shaping digital payment adoption decisions among SME operators have received limited attention. This study directly addresses these gaps.

III. RESEARCH METHODOLOGY

3.1. Research Design

This study adopted an explanatory sequential mixed-methods design, integrating quantitative survey data with qualitative interview data (Creswell & Creswell, 2018). The quantitative component was prioritized to test hypothesized structural relationships, while the qualitative component provided contextual depth and illuminated mechanisms that numerical data cannot adequately capture. This triangulation strategy enhances both the internal validity and the transferability of findings (Bryman, 2016).

3.2. Research Objectives

The specific objectives of this study are as follows:

Objective 1: To assess the level of digital payment adoption among SMEs in India, Kenya, and Vietnam.
Objective 2: To examine the effect of digital payment adoption on SME access to credit, banking relationships, and financial resilience.
Objective 3: To determine the moderating role of digital literacy and regulatory environment in the adoption-inclusion relationship.
Objective 4: To explore qualitative perceptions of benefits and barriers associated with digital payment adoption.

3.3. Hypotheses

Based on the theoretical framework and the extant literature, the following hypotheses are proposed:

- H1: Digital payment adoption has a significant positive effect on SME credit access.
- H2: Digital payment adoption has a significant positive effect on SME banking relationships.
- H3: Digital payment adoption has a significant positive effect on SME financial resilience.
- H4: Digital literacy moderates the relationship between digital payment adoption and financial inclusion.
- H5: Regulatory environment moderates the relationship between digital payment adoption and financial inclusion.

3.4. Sampling and Data Collection

The target population consisted of owner-managers of formal and semi-formal SMEs operating in three countries: India, Kenya, and Vietnam. These countries were selected purposively to represent distinct fintech development trajectories, regulatory regimes, and geographic regions, while sharing common characteristics of emerging market economies with substantial unbanked populations (Sahay et al., 2020). A stratified random sampling technique was employed, with strata defined by country, industry sector (retail, manufacturing, and services), and firm size (micro: 1 to 9 employees; small: 10 to 49 employees; medium: 50 to 249 employees). A total of 432 valid questionnaires were collected between March and August 2024, distributed as 148 from India, 141 from Kenya, and 143 from Vietnam.

For the qualitative component, 24 in-depth interviews were conducted with purposively selected SME owners who had adopted digital payment systems for at least 12 months. Participants represented diverse industry sectors and firm sizes. Interviews were conducted in local languages where necessary, professionally transcribed, and translated into English by certified translators. Each interview lasted between 45 and 75 minutes.

3.5. Measures and Instruments

The structured questionnaire comprised four sections. The first section collected demographic and firm-level data including age, gender, education, industry, firm size, and years of operation. The second section measured digital payment adoption using a validated six-item scale adapted from Davis's (1989) Technology Acceptance Model, modified for the digital payment context following Thakur and Srivastava (2015). Response options were anchored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The third section assessed financial inclusion outcomes across three dimensions: credit access (five items), banking relationships (four items), and financial resilience (five items), drawing on scales developed by Demirguc-Kunt et al. (2022). The fourth section measured the moderating variables of digital literacy (six items, adapted from Van Dijk, 2020) and regulatory environment (four items, adapted from Claessens et al., 2018).

Content validity was established through review by five academic experts in finance, information systems, and development economics. A pilot study involving 45 SME operators confirmed satisfactory Cronbach's alpha values for all constructs (ranging from 0.74 to 0.89), indicating acceptable internal consistency (Nunnally, 1978).

3.6. Analytical Strategy

Quantitative data were analyzed using IBM SPSS Statistics 29 and AMOS 29. Descriptive statistics summarized respondent profiles and construct means. Confirmatory factor analysis (CFA) was performed to assess the measurement model, evaluating construct validity through convergent validity (average variance extracted, AVE > 0.50) and discriminant validity (Fornell-Larcker criterion). Structural equation modeling (SEM) was employed to test the hypothesized relationships, with maximum likelihood estimation. Interaction terms were created using mean-centered variables to test moderation hypotheses, following the procedures recommended by Hair et al. (2019).

Qualitative data were analyzed using NVivo 14 software. An inductive-deductive hybrid approach to thematic analysis was employed, following Braun and Clarke (2006). Initial codes were generated inductively from interview transcripts, subsequently organized into themes and sub-themes, and then interpreted against the deductive framework derived from the theoretical review. Member checking and peer debriefing were undertaken to enhance trustworthiness.

VI. RESULTS

4.1. Respondent Profile

Of the 432 respondents, 61.3% were male and 38.7% were female, reflecting the gender composition of formal SME ownership documented in the IFC Enterprise Finance Gap database (IFC, 2020). The majority of respondents (54.2%) fell in the 30 to 45 age bracket. In terms of firm size, micro-enterprises accounted for 42.1% of the sample, small enterprises for 38.4%, and medium enterprises for 19.5%. The retail sector constituted the largest industry group (38.7%), followed by services (33.1%) and manufacturing (28.2%). Approximately 68% of respondents reported having adopted at least one digital payment platform at the time of the survey.

4.2. Measurement Model Assessment

CFA results confirmed adequate fit for the overall measurement model: chi-square/df = 2.38, CFI = 0.94, TLI = 0.93,

RMSEA = 0.057 (90% CI: 0.048 to 0.066), and SRMR = 0.062. All standardized factor loadings exceeded the recommended threshold of 0.60, with a range from 0.63 to 0.84. AVE values ranged from 0.51 to 0.67, satisfying the convergent validity criterion. Discriminant validity was established as the square root of AVE for each construct exceeded the inter-construct correlations (Fornell & Larcker, 1981). Common method bias was assessed using Harman's single-factor test, which yielded a single-factor variance of 22.3%, well below the threshold of 50%, suggesting that common method bias was not a serious concern (Podsakoff et al., 2003).

4.3. Structural Model and Hypothesis Testing

The structural model demonstrated acceptable fit: chi-square/df = 2.51, CFI = 0.93, TLI = 0.92, RMSEA = 0.061, SRMR = 0.068. Table 1 presents the standardized path coefficients and significance levels.

H1 posited a positive effect of digital payment adoption on credit access. The standardized path coefficient was 0.61 (SE = 0.08, t = 7.63, $p < 0.001$), providing strong support for H1. H2 examined the effect on banking relationships. The coefficient was 0.47 (SE = 0.07, t = 6.71, $p < 0.01$), supporting H2. H3 assessed the effect on financial resilience, yielding a path coefficient of 0.53 (SE = 0.09, t = 5.89, $p < 0.001$), thus supporting H3. Together, the three endogenous constructs explained variance levels of 43%, 37%, and 51% respectively.

H4 proposed that digital literacy moderates the adoption-inclusion relationship. The interaction term was significant for credit access (beta = 0.22, $p < 0.05$) and financial resilience (beta = 0.19, $p < 0.05$), but non-significant for banking relationships (beta = 0.11, $p = 0.18$). H4 was thus partially supported. H5 examined regulatory environment as a moderator. Significant interaction effects were found for all three financial inclusion outcomes (credit access: beta = 0.31, $p < 0.001$; banking relationships: beta = 0.26, $p < 0.01$; financial resilience: beta = 0.28, $p < 0.001$), providing full support for H5.

Country-level subgroup analysis using multi-group SEM revealed that path coefficients were largest in Kenya (credit access: beta = 0.69) and smallest in Vietnam (beta = 0.54), with India occupying an intermediate position (beta = 0.62). Chi-square difference tests confirmed that these cross-country variations were statistically significant (delta chi-square = 14.37, df = 4, $p < 0.01$), suggesting meaningful contextual heterogeneity.

4.4. Qualitative Findings

Thematic analysis of interview data generated three primary themes:

- Perceived economic benefits of digital payments,
- Digital and financial literacy as a double-edged factor, and
- Navigating the regulatory and trust landscape.

4.4.1. Theme 1: Perceived Economic Benefits

Participants consistently described digital payment adoption as transformative for their business operations. Enhanced record-keeping, reduced cash-handling risks, and improved access to working capital financing emerged as the most frequently cited benefits. Several participants noted that fintech lenders had contacted them proactively to offer credit products based on their transactional history, confirming the information asymmetry reduction mechanism hypothesized in the literature (Jack & Suri, 2011). One retail trader from Nairobi stated that within eight months of using a mobile payment platform, a microfinance institution offered a business loan without requiring any physical collateral, a possibility that had not existed previously.

4.4.2. Theme 2: Digital and Financial Literacy as a Double-Edged Factor

Participants with higher levels of education and prior banking experience reported a smoother transition to digital payments and greater ability to leverage associated credit products. Conversely, several participants with limited formal education expressed anxiety about data privacy, erroneous transactions, and their inability to resolve disputes through digital channels. This finding aligns with Van Dijk's (2020) argument that skills gaps can perpetuate rather than reduce digital inequalities if not addressed through targeted capacity-building interventions.

4.4.3. Theme 3: Navigating the Regulatory and Trust Landscape

The regulatory theme revealed considerable variation across the three study countries. Kenyan respondents expressed relatively high confidence in the regulatory framework governing mobile money, attributing this to the long-standing role of the Central Bank of Kenya in overseeing mobile financial services. Indian participants displayed a more mixed perception, citing the 2016 demonetization experience as having both accelerated digital adoption and generated residual distrust in government-mandated financial changes. Vietnamese participants noted that evolving regulations had created uncertainty, with some platforms adjusting service offerings in response to policy changes.

V. DISCUSSION

The findings of this study make several important contributions to the financial inclusion and SME finance literatures. The strong positive effect of digital payment adoption on credit access (H1 supported, beta = 0.61) corroborates and extends the prior work of Gutierrez-Nieto et al. (2023) and Munyegera and Matsumoto (2016) to a multi-country enterprise-level context. The mechanism appears to operate through transactional data transparency, as the qualitative evidence suggests that fintech lenders proactively identify and target SMEs exhibiting consistent digital payment behavior.

The significant moderation by regulatory environment (H5 fully supported) has important practical implications. It indicates that the benefits of digital payment adoption for financial inclusion are not automatic but are conditioned by the quality and proportionality of the surrounding regulatory ecosystem. This is consistent with Claessens et al. (2018) and Sahay et al. (2020), who argued that regulatory frameworks must balance innovation incentives with stability and consumer

protection objectives. The cross-country variation in effect sizes, with Kenya outperforming India and Vietnam, further underscores the relevance of country-specific regulatory maturity.

The partial support for the digital literacy moderation hypothesis (H4) is noteworthy. The non-significant moderation of the banking relationships pathway suggests that basic platform usage, even without high digital literacy, may be sufficient to establish institutional banking connections, perhaps because formal financial institutions have invested in simplifying onboarding processes. However, the significant moderation of credit access and financial resilience pathways indicates that higher literacy is required to translate digital engagement into more sophisticated financial outcomes. This nuance has been underappreciated in prior research.

From a theoretical standpoint, the findings affirm the relevance of information economics (Stiglitz & Weiss, 1981) as an explanatory framework and extend it by demonstrating that digital payment systems serve as endogenous mechanisms for overcoming information asymmetries at the firm level. The Technology Acceptance Model, originally developed by Davis (1989) in a North American organizational context, demonstrates adequate cross-cultural validity in predicting adoption behavior among SMEs in diverse developing economy settings, albeit with contextual modifications.

The qualitative findings add depth by illuminating the heterogeneous experiences of SME operators and the role of trust, prior financial experiences, and institutional confidence in shaping adoption trajectories. These dimensions are not fully captured by quantitative constructs and point to the value of mixed-methods approaches in financial inclusion research.

VI. CONCLUSION

This study provides robust multi-country evidence that digital payment adoption significantly enhances financial inclusion among SMEs in developing economies, operating through mechanisms of information transparency, institutional trust-building, and improved creditworthiness signaling. The findings confirm that digital payments are not merely transactional conveniences but serve as foundational financial infrastructure with far-reaching implications for enterprise development and economic inclusion.

For policymakers, the findings underscore the importance of cultivating enabling regulatory environments that provide clarity, proportionality, and consumer protection without stifling innovation. Particular attention should be given to cross-border regulatory harmonization, given the increasingly transnational nature of fintech service provision.

For financial institutions and fintech providers, the study highlights the commercial opportunity in developing credit and savings products specifically tailored to SMEs with established digital payment histories. Investing in digital literacy programs as part of customer onboarding will enhance the ability of SMEs to leverage the full suite of financial services available through digital channels.

For development organizations, the study's evidence on digital literacy as a moderator of financial outcomes validates ongoing investments in financial and digital education programs targeting SME operators, particularly women and operators with lower formal education.

This study has several limitations that should be acknowledged. The cross-sectional design precludes causal inference, and longitudinal research is needed to establish temporal precedence in the adoption-inclusion relationship. The sample, while cross-country, is confined to urban and peri-urban areas, and findings may not generalize to deeply rural contexts. Future research should examine the role of specific platform types, peer networks, and sectoral differences in shaping adoption and financial outcomes.

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E-Commerce Adoption and Its Effect on Revenue Growth Among Women-Owned Micro-Enterprises: A Multi-Regional Study in Sub-Saharan Africa

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Abstract

Women-owned micro-enterprises represent a significant segment of the informal and semi-formal commercial landscape in Sub-Saharan Africa, yet they remain disproportionately excluded from the growth opportunities afforded by digital commerce. This study investigates the extent to which e-commerce adoption influences revenue growth, market reach, and business sustainability among women-owned micro-enterprises in Nigeria, Ghana, and Senegal. A convergent parallel mixed-methods design was employed, combining quantitative survey data from 518 women entrepreneurs with qualitative data from 30 focused group discussions. Multiple regression analysis, propensity score matching, and cross-case thematic analysis were deployed to analyze the data. Results indicate that e-commerce adoption is associated with a statistically significant increase in monthly revenue (mean difference = 34.7%, $p < 0.001$) and an expanded customer base extending beyond local geographic boundaries. Social capital, smartphone ownership, and access to reliable logistics services emerged as significant enabling conditions. Barriers including platform transaction fees, internet affordability, and gender-specific social norms were found to attenuate adoption benefits. The study contributes empirical evidence at the intersection of gender, digital commerce, and enterprise development, with implications for inclusive economic policy in the African Continental Free Trade Area context.

Keywords: - E-Commerce Adoption, Women Entrepreneurship, Micro-Enterprises, Sub-Saharan Africa, Revenue Growth, Digital Commerce, Propensity Score Matching

I. INTRODUCTION

The digital economy has restructured the boundaries of market participation, enabling enterprises of all sizes to access customers, suppliers, and capital through online channels previously unavailable to small operators (UNCTAD, 2021). Within Sub-Saharan Africa, the rapid diffusion of mobile internet and smartphone technology has created a structural window for micro-enterprises to transition from geographically constrained informal trade to participation in regional and global e-commerce ecosystems (Mastercard Foundation, 2020). This transition carries particular significance for women-owned micro-enterprises, which account for an estimated 58% of informal commercial activity in the region yet face persistent structural disadvantages in accessing formal markets, finance, and business development services (ILO, 2019).

The African Continental Free Trade Area (AfCFTA), operationalized in January 2021, has further elevated interest in digital trade infrastructure as a mechanism for enabling micro and small enterprise participation in continental value chains (African Union, 2021). Policymakers, development finance institutions, and private sector actors have converged on the proposition that e-commerce adoption represents a lever for accelerating women's economic empowerment. Yet the evidence base underpinning this proposition remains uneven. While descriptive market reports document rising platform usage, rigorous academic studies that isolate the causal or quasi-causal effect of e-commerce adoption on enterprise-level revenue outcomes are scarce, particularly in francophone West Africa.

Furthermore, existing studies have tended to treat e-commerce adoption as a binary variable, obscuring important heterogeneity in how women entrepreneurs engage with digital platforms. The distinction between passive product listing on aggregator platforms and active management of social commerce channels, for instance, may carry significantly different implications for revenue generation and market development. Equally, the enabling and constraining conditions that shape whether adoption translates into sustainable revenue growth remain undertheorized.
Against this backdrop, this study addresses three overarching research questions:

- What is the effect of e-commerce adoption on monthly revenue among women-owned micro-enterprises in Nigeria, Ghana, and Senegal?
- What conditions enable or constrain the translation of e-commerce adoption into revenue growth?
- How do women entrepreneurs in diverse regional contexts perceive the social and commercial dimensions of digital platform engagement?

The remainder of the paper proceeds as follows. Section 2 reviews the theoretical and empirical literature. Section 3 describes the research methodology, including design, sampling, data collection, and analysis. Section 4 presents the results. Section 5 discusses the findings and their implications. Section 6 concludes with recommendations and limitations.

II. LITERATURE REVIEW

2.1. Women's Entrepreneurship and Digital Commerce in Sub-Saharan Africa

Women's entrepreneurship in Sub-Saharan Africa has been extensively studied through the lens of constraints rather than opportunities, with the literature cataloguing barriers including limited access to finance, restricted mobility, lower formal education attainment, and discriminatory social norms (Aterido et al., 2011; World Bank, 2022). Brixiova and Kangoye (2016) demonstrated, using firm-level data from African Development Bank enterprise surveys, that women-owned firms in the region are significantly smaller and less productive than male-owned counterparts, with market access constraints constituting the single largest explanatory factor.

Digital technologies have been theorized as potential equalizers capable of reducing the transaction costs associated with geographic market limitations (Molla & Heeks, 2007). Mobile commerce, in particular, has attracted scholarly and policy attention as a low-barrier entry point to digital markets in contexts characterized by limited fixed broadband infrastructure (Asongu & Nwachukwu, 2018). Empirical support for this equalizing potential has been mixed, however. Atieno (2019) found that Kenyan women traders using social media platforms for commerce reported higher customer reach, but that conversion to revenue was mediated by logistics capabilities and trust-building mechanisms.

2.2. E-Commerce Adoption Theories and Frameworks

The theoretical literature on e-commerce adoption draws primarily from innovation diffusion theory (Rogers, 2003), the Technology Acceptance Model (Davis, 1989), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). Applied to the micro-enterprise context, these frameworks emphasize perceived usefulness, ease of use, and social influence as primary determinants of adoption intention and behavior. Grandon and Pearson (2004) extended these models to include organizational and environmental factors, arguing that perceived strategic value and competitive pressure from peers significantly accelerate adoption among small enterprises.

For women entrepreneurs in developing economies, Duncombe (2011) proposed a contextual IS framework that foregrounds socio-cultural norms as first-order determinants of technology engagement, arguing that standard adoption models imported from Northern contexts underestimate the role of institutional and relational factors. This insight has particular salience for Sub-Saharan Africa, where gender norms around mobility, control of income, and participation in public commercial spaces may interact with digital adoption decisions in non-obvious ways.

2.3. E-Commerce and SME Revenue Performance

Studies linking e-commerce adoption to enterprise revenue performance in developing country contexts have proliferated since the mid-2010s. Qiang et al. (2011) provided early cross-country evidence that internet use by enterprises was associated with higher sales growth, even after controlling for firm size and sector. More recently, Goldfarb and Tucker (2019) reviewed digital commerce research and concluded that online market participation reduces search frictions and enables price discovery in ways that are disproportionately beneficial to smaller firms.

Africa-specific evidence has expanded considerably with the growth of mobile commerce platforms. Ndung'u (2019) documented that Kenyan micro-enterprises participating in digital market platforms reported average revenue increases of 28% over a 12-month period compared to non-adopters, while controlling for pre-adoption firm characteristics. Lashitew et al. (2019) provided cross-country evidence from Sub-Saharan Africa showing that mobile money and e-commerce co-adoption was associated with higher firm-level productivity, with particularly pronounced effects for micro-enterprises in the retail sector.

2.4. Enabling Conditions and Constraining Factors

The heterogeneity of e-commerce outcomes across firms and contexts has prompted growing attention to enabling conditions. Turban et al. (2018) identified logistics infrastructure, digital payment integration, customer trust, and digital literacy as the four pillars of a functional e-commerce ecosystem for small enterprises. In Sub-Saharan Africa, the logistics dimension is particularly salient, given the significant variation in road infrastructure quality, last-mile delivery capability, and address standardization across and within countries (Mastercard Foundation, 2020).

Social capital has also emerged as an important enabling factor. Ellison and Vitak (2015) demonstrated that dense social networks, both online and offline, facilitate the rapid diffusion of commercial information and trust signals necessary for digital market transactions. For women entrepreneurs, informal trade networks and rotating savings groups have historically served as platforms for trust-based commerce, and digital extensions of these networks may lower the cognitive and social barriers to e-commerce adoption (Asongu & Nwachukwu, 2018).

2.5. Research Gaps

Despite this expanding literature, three significant gaps persist. First, most studies rely on cross-sectional data, and the potential endogeneity of e-commerce adoption, whereby more commercially successful women may be more likely to adopt, has not been adequately addressed through quasi-experimental or matching methods. Second, comparative studies spanning Anglophone and francophone Sub-Saharan African contexts are rare, limiting the generalizability of findings. Third, qualitative evidence that captures the social dimensions and lived experiences of women entrepreneurs navigating digital commerce is largely absent from quantitative-dominant studies. This study addresses all three gaps.

III. RESEARCH METHODOLOGY

3.1. Research Design

A convergent parallel mixed-methods design was adopted for this study (Creswell & Plano Clark, 2018). Quantitative and qualitative data were collected simultaneously and independently, analyzed separately, and then merged at the interpretation stage. The rationale for convergence rather than sequencing was to allow triangulation of findings and to avoid the potential influence of quantitative results on qualitative inquiry (Bryman, 2016). The quantitative strand was designed to estimate the magnitude and statistical significance of e-commerce effects on revenue, while the qualitative strand explored mechanisms, contexts, and subjective meanings that numeric data cannot capture.

3.2. Research Objectives

This study was guided by the following specific research objectives:

- Objective 1: To document the prevalence and depth of e-commerce adoption among women-owned micro-enterprises in Nigeria, Ghana, and Senegal.
- Objective 2: To estimate the effect of e-commerce adoption on monthly enterprise revenue using propensity score matching to address selection bias.
- Objective 3: To identify enabling conditions and barriers that moderate the relationship between e-commerce adoption and revenue growth.
- Objective 4: To explore women entrepreneurs' perceptions of social capital, trust, and identity in relation to digital platform participation.

3.3. Hypotheses

The following hypotheses were formulated to guide the quantitative analysis:

- H1: Women-owned micro-enterprises that adopt e-commerce platforms report significantly higher monthly revenue than non-adopters.
- H2: Social capital positively moderates the relationship between e-commerce adoption and revenue growth.
- H3: Logistics access positively moderates the relationship between e-commerce adoption and revenue growth.
- H4: Internet affordability constraints negatively moderate the relationship between e-commerce adoption and revenue growth.
- H5: Smartphone ownership is a significant positive predictor of e-commerce adoption among women micro-entrepreneurs.

3.4. Study Area and Sampling

The study was conducted in three countries selected to represent geographic, linguistic, and regulatory diversity within Sub-Saharan Africa: Nigeria (West Africa, Anglophone, largest economy), Ghana (West Africa, Anglophone, upper-middle income), and Senegal (West Africa, francophone, rapidly growing fintech ecosystem). Urban, peri-urban, and rural sites were included within each country, with data collection centered on commercial hubs: Lagos and Abuja in Nigeria, Accra and Kumasi in Ghana, and Dakar and Thies in Senegal.

Purposive stratified random sampling was employed, targeting women-owned micro-enterprises (defined as formally or informally registered businesses with fewer than 10 employees and sole or majority female ownership) operating in retail trade, food and beverages, textiles and fashion, and personal services. A total of 518 complete and valid questionnaires were obtained, distributed as 182 from Nigeria, 171 from Ghana, and 165 from Senegal. For the qualitative component, 30 focus group discussions were conducted, with 6 to 8 participants each, stratified by country, sector, and adoption status.

3.5. Data Collection Instruments

The structured questionnaire comprised five sections. Section A collected socio-demographic and firm-level data. Section B assessed e-commerce adoption using a seven-item scale adapted from Grandon and Pearson (2004) and modified for the mobile commerce context in developing economies, capturing adoption depth across five platforms: social media commerce (WhatsApp Business, Facebook Marketplace), dedicated marketplace platforms (Jumia, Tonaton, Dakar Mall), own website, mobile payment integration, and logistics platform use. Section C measured monthly revenue performance using

reported figures cross-validated against mobile money transaction records where available. Section D assessed enabling conditions: social capital (eight items, adapted from Ellison & Vitak, 2015), logistics access (five items), and internet affordability (four items). Section E captured moderating and control variables including education level, years of business operation, household income, and marital status.

The questionnaire was translated into Hausa and Yoruba for Nigeria, Twi for Ghana, and French and Wolof for Senegal, and back-translated by independent bilingual experts to verify semantic equivalence. A pilot study involving 52 participants confirmed adequate Cronbach's alpha values across all scales (ranging from 0.71 to 0.86). Focus group discussion guides were semi-structured and covered platform selection rationale, perceived benefits and challenges, social network dynamics, and aspirations for enterprise growth.

3.6. Analytical Strategy

Quantitative analysis proceeded in three stages. First, descriptive statistics and chi-square tests characterized the sample and tested bivariate differences between adopters and non-adopters. Second, propensity score matching (PSM) using the nearest-neighbor matching algorithm with a caliper of 0.01 was applied to construct a counterfactual comparison group, reducing selection bias arising from the non-random nature of adoption. Matching variables included age, education, years in business, prior bank account ownership, smartphone ownership, and sector. The average treatment effect on the treated (ATT) was calculated as the primary estimate of e-commerce adoption impact on revenue. Third, ordinary least squares (OLS) regression with robust standard errors was employed on the matched sample to test the moderation hypotheses, using mean-centered interaction terms as recommended by Aiken and West (1991). Stata 17 was used for all quantitative analyses.

Qualitative data from focus group discussions were transcribed verbatim, translated where necessary, and analyzed using ATLAS.ti 23 software. Framework analysis was applied as the primary qualitative method, given its suitability for applied policy-oriented research with multiple cases (Ritchie & Spencer, 1994). A common analytical framework was developed inductively from initial coding of Nigerian transcripts and then applied systematically to Ghanaian and Senegalese data, enabling structured cross-country comparison. Intercoder reliability was assessed using Cohen's kappa, with an average value of 0.78 indicating substantial agreement.

IV. RESULTS

4.1. Sample Characteristics and Adoption Profile

Of the 518 respondents, the mean age was 34.6 years (SD = 7.3). Formal education levels varied considerably: 18.3% had completed primary education only, 47.1% had secondary education, and 34.6% had tertiary qualifications. Approximately 71.4% of respondents owned a smartphone, and 63.5% reported access to mobile internet at least several times per week. Overall e-commerce adoption stood at 53.7%, with meaningful variation across countries: Nigeria (61.5%), Ghana (55.6%), and Senegal (43.6%). Social media commerce was the most prevalent form of adoption (41.3% of the full sample), followed by mobile payment integration without formal platform listing (31.5%), and registered marketplace platform participation (19.1%). Only 7.3% of adopters reported operating a dedicated business website.

4.2. Pre-Matching Comparison and Propensity Score Matching

Prior to matching, adopters differed significantly from non-adopters on several observable characteristics. Adopters were more likely to own smartphones (89.6% vs. 50.3%, chi-square = 84.37, $p < 0.001$), had higher mean education levels, and were more likely to hold a formal bank account (62.4% vs. 39.8%, $p < 0.001$). These differences confirmed the necessity of PSM to isolate adoption effects from pre-existing differences.

After applying nearest-neighbor PSM, 248 matched pairs were retained (total N = 496 in matched sample). Standardized mean differences for all matching variables fell below 0.10 post-matching, indicating satisfactory covariate balance. A sensitivity analysis using the Rosenbaum bounds approach confirmed that results were robust to moderate levels of hidden bias (Gamma = 1.8 for the primary revenue outcome).

4.3. Effect of E-Commerce Adoption on Revenue

In the matched sample, the ATT estimate indicated that e-commerce adopters reported an average monthly revenue 34.7 percentage points higher than matched non-adopters (95% CI: 27.3% to 42.1%, $p < 0.001$), providing strong support for H1. Country-disaggregated ATT estimates were: Nigeria, 38.2% ($p < 0.001$); Ghana, 35.0% ($p < 0.001$); and Senegal, 29.8% ($p < 0.001$). The smaller effect in Senegal was consistent with lower logistics infrastructure quality and more nascent digital commerce ecosystem indicators in that context (UNCTAD, 2021).

The OLS moderation analysis on the matched sample yielded significant positive interaction terms for social capital (beta = 0.24, $p < 0.01$), supporting H2, and logistics access (beta = 0.31, $p < 0.001$), supporting H3. The interaction term for internet affordability constraints was negative and significant (beta = -0.19, $p < 0.05$), supporting H4. Smartphone ownership was a significant positive predictor of adoption in logistic regression (OR = 5.37, 95% CI: 3.41 to 8.45, $p < 0.001$), confirming H5. Together, the model explained 52% of the variance in revenue growth (adjusted R-squared = 0.52).

4.4. Focus Group Findings

Framework analysis of the 30 focus group discussions generated four thematic domains:

- Platform selection and trust formation
- The social embeddedness of digital commerce
- Logistical and infrastructural realities
- Gender norms and household negotiations.

4.4.1. Theme 1: Platform Selection and Trust Formation

Participants across all three countries overwhelmingly preferred WhatsApp Business and Facebook Marketplace over formal marketplace platforms, citing lower transaction fees, greater perceived control over customer relationships, and pre-existing social ties with buyers. This preference aligns with Ellison and Vitak's (2015) observation that trust-based social network commerce reduces the perceived risk of digital transactions in low-institutional-trust environments. Several participants described elaborate informal reputation systems, including shared customer reviews in WhatsApp groups, that functioned as substitute mechanisms for the formal ratings and escrow services offered by larger platforms.

4.4.2. Theme 2: Social Embeddedness of Digital Commerce

A prominent cross-country finding was that e-commerce adoption was rarely an individual decision but was embedded in dense networks of women entrepreneurs who shared platform knowledge, customer referrals, and collective troubleshooting. Participants described peer learning as the primary mode of acquisition for digital commerce skills, with more experienced adopters informally mentoring newer entrants. This finding extends Asongu and Nwachukwu (2018) by demonstrating that social capital functions not only as a moderator of revenue outcomes but as an active facilitator of adoption itself, creating self-reinforcing adoption clusters within trading communities.

4.4.3. Theme 3: Logistical and Infrastructural Realities

Logistics emerged as the most practically salient operational challenge across all sites. Participants in Lagos and Accra reported access to multiple competing delivery services, enabling competitive pricing and relatively reliable fulfillment. By contrast, participants in Thies and rural Ghanaian sites described ad hoc delivery arrangements using personal contacts and public transport, which limited scalable growth. Several Senegalese participants noted that the unavailability of standardized address systems had led buyers to default to in-person collection, effectively negating the geographic market expansion benefit of e-commerce.

4.4.4. Theme 4: Gender Norms and Household Negotiations

A distinctive qualitative finding was the extent to which household gender dynamics influenced e-commerce engagement. Several participants described negotiating with husbands or male relatives for permission to use smartphones for business purposes, citing concerns about unsupervised communication with male customers as a source of household friction. This finding echoes Duncombe's (2011) contextual IS framework and adds a layer of specificity to quantitative moderation findings, suggesting that gender norm variables, while difficult to operationalize quantitatively, represent a substantive conditioning factor in adoption outcomes.

V. DISCUSSION

The findings of this study provide the most methodologically rigorous enterprise-level evidence to date on the revenue effects of e-commerce adoption among women-owned micro-enterprises in Sub-Saharan Africa. The PSM-estimated ATT of approximately 34.7% in monthly revenue represents a substantial and practically significant effect, even accounting for the conservative matching procedure applied. This magnitude is broadly consistent with Ndung'u's (2019) Kenyan estimate of 28% and with Lashitew et al.'s (2019) panel estimates, while extending those findings to a multi-country and gender-specific context.

The moderation findings carry important nuance. The strong positive moderation by logistics access (beta = 0.31) suggests that revenue benefits from e-commerce adoption are substantially contingent on the availability of reliable fulfillment infrastructure. This has direct implications for the sequencing of policy interventions: investments in digital commerce platforms without commensurate investment in logistics ecosystems are unlikely to generate equitable revenue improvements, particularly in smaller urban and rural settings. This insight is aligned with the UNCTAD (2021) observation that logistics gaps represent the primary bottleneck in African e-commerce development.

The positive moderation by social capital (H2 supported, beta = 0.24) reinforces the social embeddedness perspective documented in the qualitative findings. This represents a theoretically significant contribution, suggesting that innovations in women's e-commerce support should leverage rather than displace existing social trading networks. Peer-to-peer platform structures, community-based digital literacy programs, and cooperative logistics arrangements may be particularly effective in contexts where informal social capital already underpins commercial activity.

The negative moderation by internet affordability constraints (H4 supported, beta = -0.19) aligns with the digital divide literature and confirms that cost barriers are not merely adoption barriers but ongoing moderators of performance among existing adopters. Women entrepreneurs who adopt digital platforms under conditions of constrained internet access are unable to fully leverage the capabilities of those platforms, resulting in systematically lower revenue gains. This finding argues for targeted data subsidy programs directed at small business operators as a complement to platform development investments.

The cross-country variation in effect sizes, with Nigeria showing the largest ATT and Senegal the smallest, is theoretically interpretable through the lens of digital ecosystem maturity. Nigeria's larger and more competitive delivery services sector, combined with a more established consumer e-commerce culture anchored by platforms such as Jumia Nigeria, appears to create more fertile conditions for micro-enterprise e-commerce revenue generation. Senegal's smaller and more nascent ecosystem, despite its rapidly expanding mobile money infrastructure, has not yet achieved comparable logistical and consumer trust conditions. This contextual heterogeneity underlines the limits of uniform policy recommendations and the necessity of country-specific diagnostic approaches.

VI. CONCLUSION

This study advances knowledge at the intersection of digital commerce, gender, and enterprise development in Sub-Saharan Africa by providing quasi-experimental evidence that e-commerce adoption generates substantial revenue gains for women-owned micro-enterprises. The average treatment effect of approximately 35% in monthly revenue, replicated consistently across three countries with distinct institutional and cultural contexts, constitutes strong evidence for the economic value of digital platform participation. At the same time, the study reveals that this value is not automatic but is contingent on logistics infrastructure, social capital, internet affordability, and gender-inclusive institutional environments.

For national policymakers and the African Union's AfCFTA Secretariat, the findings argue for a comprehensive digital commerce enabling environment that addresses logistics, connectivity, and gender norms simultaneously. Piecemeal interventions targeting only platform development or only digital literacy will generate suboptimal and inequitable outcomes. A systems approach that co-invests in last-mile logistics, community-based digital education, affordable data tariffs, and gender-responsive regulatory frameworks is needed to unlock the full inclusive potential of e-commerce in the region.

For development finance institutions and impact investors, the study highlights the potential for gender-lens digital commerce funds that target women micro-entrepreneurs in logistics-constrained environments, coupling capital with technical assistance in platform management and supply chain development. For e-commerce platform operators, the evidence on social embeddedness suggests that community-based platform architectures that replicate and extend existing social trading networks may achieve higher adoption depth and revenue outcomes than standard marketplace models.

Several limitations warrant acknowledgment. The cross-sectional nature of the data, despite PSM adjustment, cannot fully establish causal direction, and longitudinal cohort studies are needed to track adoption trajectories and revenue dynamics over time. The study focused on formal and semi-formal micro-enterprises, and findings may not generalize to the deeply informal sector, which constitutes a substantial share of women's economic activity in the region. Future research should examine the specific mechanisms linking social commerce platforms to credit access, explore the role of digital commerce in value chain integration under AfCFTA, and investigate how platform algorithm design affects visibility and revenue opportunities for women vendors.

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Blockchain Technology Adoption in Trade Finance: Implications for Cross-Border Transaction Efficiency and Trust Among Emerging Market Enterprises

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Abstract

Cross-border trade finance remains one of the most friction-intensive domains of international commerce, characterized by documentary redundancies, prolonged settlement cycles, and persistent trust deficits among counterparties operating across heterogeneous legal and institutional environments. Blockchain technology, with its properties of immutability, distributed consensus, and programmable smart contracts, has been widely proposed as a structural solution to these inefficiencies. Yet rigorous empirical evidence on whether and how blockchain adoption translates into measurable efficiency and trust gains for enterprises in emerging markets remains limited. This study employs a longitudinal panel design spanning 36 months to examine blockchain adoption outcomes among 284 export-oriented enterprises in South Africa, India, and Taiwan. Difference-in-differences estimation with firm fixed effects is used to isolate the causal effect of blockchain platform adoption on three outcomes: trade document processing time, letter of credit discrepancy rates, and inter-firm trust scores. Results indicate that blockchain adoption reduces average document processing time by 61.4% ($p < 0.001$), letter of credit discrepancy rates by 44.2% ($p < 0.001$), and significantly improves inter-firm trust scores (Cohen's $d = 0.79$). Interoperability constraints, legacy system integration costs, and regulatory uncertainty are identified as primary barriers to scaling adoption. The study contributes to the nascent empirical literature on blockchain in trade finance and offers actionable recommendations for enterprises, financial intermediaries, and trade facilitation bodies.

Keywords: - Blockchain, Trade Finance, Smart Contracts, Cross-Border Commerce, Transaction Efficiency, Emerging Markets, Difference-In-Differences

I. INTRODUCTION

International trade is the engine of economic integration and growth, yet the documentary and institutional infrastructure underpinning cross-border transactions has changed remarkably little since the codification of the Uniform Customs and Practice for Documentary Credits by the International Chamber of Commerce in 1933. Letters of credit, bills of lading, certificates of origin, and commercial invoices continue to circulate largely on paper or in non-interoperable digital formats, generating significant friction, error, and delay at every node of the trade finance chain (ICC, 2020). The World Trade Organization estimated in 2019 that trade documentation costs account for between 5 and 15 percent of total transaction value for cross-border shipments involving emerging market participants, a burden that falls disproportionately on smaller exporters with limited capacity to absorb processing delays and discrepancy resolution costs (WTO, 2019).

Blockchain technology, originally conceptualized by Nakamoto (2008) as a mechanism for peer-to-peer electronic cash transfer, has attracted intense interest from the trade finance community as a potential structural remedy for documentary inefficiency and counterparty trust deficits (Ganne, 2018). The core properties of distributed ledger technology including immutable transaction records, shared visibility across permissioned network participants, and programmable smart contract execution offer a conceptually compelling architecture for trade document management, letter of credit automation, and supply chain provenance verification (Tapscott & Tapscott, 2016). Major financial institutions including HSBC, Standard Chartered,

and DBS Bank, as well as multilateral platforms such as we.trade and Contour, have deployed blockchain-based trade finance systems in operational environments since 2018.

Despite this commercial momentum, the academic literature on blockchain adoption outcomes in trade finance contexts remains sparse and methodologically limited. Most published studies are conceptual or case-based, documenting implementation experiences without rigorously isolating causal effects (Kamble et al., 2019). The few quantitative studies available draw primarily on single-country samples from advanced economies, leaving open fundamental questions about whether efficiency and trust benefits observed in high-institutional-capacity environments translate to emerging market contexts where the need for transaction cost reduction is most acute (Kouhizadeh et al., 2021).

Furthermore, the literature has paid insufficient attention to the heterogeneity of blockchain adoption outcomes across enterprise types, trade corridors, and commodity categories. The moderating roles of firm-level absorptive capacity, trade partner network characteristics, and national regulatory frameworks have not been systematically examined. This study addresses these gaps through a rigorous multi-country longitudinal analysis that exploits the staggered rollout of blockchain platforms across a panel of export-oriented enterprises.

This study is guided by three research questions:

- Does blockchain adoption significantly reduce trade document processing time and letter of credit discrepancy rates among emerging market exporters?
- Does blockchain adoption enhance inter-firm trust in cross-border trade relationships?
- What enterprise-level and contextual factors moderate the efficiency and trust effects of blockchain adoption?

The paper proceeds as follows. Section 2 reviews the theoretical foundations and empirical literature. Section 3 describes the research methodology. Section 4 presents the empirical results. Section 5 discusses findings and their implications. Section 6 concludes with recommendations and limitations.

II. Literature Review

2.1. The Architecture of Trade Finance Inefficiency

Trade finance facilitates approximately 80% of global merchandise trade through instruments that mitigate payment risk and provide working capital to exporters and importers (ICC, 2020). Letters of credit, the most widely used instrument in emerging market trade corridors, involve a multi-party documentary chain that typically requires 5 to 10 business days for processing and generates discrepancy rates exceeding 70% on first presentation, according to the ICC's annual Trade Register (ICC, 2020). These discrepancies primarily arise from manual data entry errors, inconsistencies across independently prepared documents, and mismatches between physical goods and documentary descriptions.

Transaction cost theory, as elaborated by Williamson (1985), provides a foundational framework for understanding these inefficiencies. Williamson identified asset specificity, uncertainty, and transaction frequency as the primary determinants of governance choice. Trade finance transactions, characterized by high uncertainty arising from geographic and institutional distance, high asset specificity in the form of customized documentary requirements, and high repetition, are prime candidates for governance mechanisms that reduce opportunism and information asymmetry. Conventional trade finance addresses these challenges through relational contracting and bank intermediation, both of which are costly and dependent on pre-existing institutional trust (North, 1990).

2.2. Blockchain as a Trade Finance Infrastructure

Blockchain technology addresses trade finance inefficiencies through three primary mechanisms. First, shared distributed ledgers eliminate documentary duplication by enabling all permissioned parties including exporters, importers, freight forwarders, port authorities, banks, and insurers to access a single version of transactional truth in real time (Ganne, 2018). Second, smart contracts automate conditional payment release and document verification, reducing manual processing steps and associated error rates. Third, cryptographic hashing and consensus mechanisms create immutable audit trails that deter fraud and reduce the verification burden on intermediaries (Tapscott & Tapscott, 2016).

Early empirical evidence from blockchain pilots supports these theoretical mechanisms. HSBC reported that its blockchain-based letter of credit transaction for Cargill in 2018 was completed in 24 hours compared to the conventional 5 to 10 day processing cycle, representing a reduction of approximately 80% (HSBC, 2018). Contour, a blockchain trade finance network built on R3's Corda platform, reported a 90% reduction in letter of credit processing time across its pilot transactions (Contour, 2020). These figures, while striking, derive from controlled pilot environments and may not generalize to diverse operational contexts with heterogeneous counterparty technological capabilities.

2.3. Blockchain Adoption in Emerging Market Trade Contexts

The application of blockchain to trade finance in emerging markets presents both heightened opportunity and distinctive challenges. On the opportunity side, emerging market trade corridors typically exhibit higher documentation costs, greater counterparty opacity, and weaker institutional enforcement mechanisms, suggesting that trust-enhancing distributed ledger infrastructure could generate proportionally larger efficiency gains (Kouhizadeh et al., 2021). On the challenge side, the absorptive capacity constraints common among emerging market firms, including limited IT infrastructure, lower digital literacy, and constrained investment budgets, may impede adoption depth and limit the realization of potential benefits (Cohen & Levinthal, 1990).

Kamble et al. (2019) examined blockchain adoption intentions among Indian supply chain managers and found that perceived usefulness, trust in technology, and top management support were the strongest predictors of adoption, consistent with the Technology Acceptance Model (Davis, 1989). Queiroz and Fosso Wamba (2019) conducted a comparative study of

blockchain adoption intentions in the United States and India, finding that social influence and facilitating conditions exerted stronger effects in the Indian context, suggesting that network externalities and institutional support play more critical roles in adoption decisions in emerging economies.

2.4. Trust in Cross-Border Trade Relationships

Trust is a foundational governance mechanism in international commerce, particularly in contexts where formal legal enforcement is costly, slow, or unavailable (Zucker, 1986). Sako (1992) distinguished three forms of commercial trust: contractual trust (adherence to agreements), competence trust (belief in counterparty capability), and goodwill trust (commitment beyond contractual obligation). Dyer and Chu (2003) demonstrated empirically that higher inter-firm trust reduces transaction costs in automotive supplier relationships across the United States, Japan, and Korea, providing cross-cultural validation of trust's economic value.

The relationship between blockchain and commercial trust has received growing theoretical attention. Lumineau et al. (2021) argued that blockchain does not simply replicate institutional trust mechanisms but creates a distinct form of technology-mediated trust grounded in algorithmic consensus rather than relational reputation or third-party verification. This distinction has important implications for emerging market trade finance, where relational trust built through repeated interactions has historically been the primary governance mechanism and where the displacement or supplementation of relational trust by technological mechanisms may have complex and unpredictable effects.

2.5. Research Gaps

Four specific gaps motivate this study. First, longitudinal panel designs that track pre- and post-adoption outcomes for the same firms are absent from the empirical blockchain trade finance literature. Second, the causal identification problem, arising from the fact that technologically advanced firms are both more likely to adopt blockchain and to perform better on efficiency metrics, has not been adequately addressed. Third, cross-country comparative evidence from emerging markets spanning Asia and Africa is entirely lacking. Fourth, trust as an outcome variable rather than merely an adoption antecedent has received insufficient empirical attention in the trade finance context.

III. RESEARCH METHODOLOGY

3.1. Research Design

This study employed a longitudinal panel design with a 36-month observation window from January 2022 to December 2024. The design exploits the staggered adoption of blockchain trade finance platforms by firms within the panel to implement difference-in-differences (DiD) estimation, a quasi-experimental approach that controls for time-invariant firm-level confounders and common temporal trends. This design was selected because it offers stronger causal identification than cross-sectional designs while remaining feasible in operational commercial research contexts where randomized controlled trials are not practicable (Angrist & Pischke, 2009). A nested qualitative component comprising semi-structured interviews was incorporated to probe mechanisms and contextual factors beyond the reach of quantitative estimation.

3.2. Research Objectives

The study was structured around the following specific research objectives:

- Objective 1: To measure changes in trade document processing time following blockchain platform adoption using pre-post firm-level panel data.
- Objective 2: To assess the effect of blockchain adoption on letter of credit discrepancy rates among panel firms.
- Objective 3: To evaluate whether blockchain adoption generates measurable improvements in inter-firm trust scores among cross-border trade partners.
- Objective 4: To identify firm-level and contextual moderators of blockchain adoption outcomes.
- Objective 5: To document qualitative evidence on perceived barriers and enablers of blockchain integration in trade finance operations.

3.3. Hypotheses

The following hypotheses were specified for empirical testing:

- H1: Blockchain platform adoption significantly reduces trade document processing time among export-oriented enterprises.
- H2: Blockchain platform adoption significantly reduces letter of credit discrepancy rates.
- H3: Blockchain platform adoption significantly improves inter-firm trust scores between trading partners.
- H4: Firm-level absorptive capacity positively moderates the relationship between blockchain adoption and efficiency outcomes.
- H5: Regulatory clarity positively moderates the relationship between blockchain adoption and inter-firm trust outcomes.

3.4. Sample and Data Collection

The target population comprised export-oriented enterprises with annual export revenues exceeding USD 500,000 and a minimum of three years of cross-border trading experience. Three countries were selected to represent distinct institutional environments, blockchain regulatory stances, and trade finance ecosystem maturity levels: South Africa (Africa's most sophisticated financial services market with a cautiously enabling blockchain regulatory posture), India (a major emerging

economy with rapidly expanding fintech infrastructure and a growing blockchain regulatory dialogue), and Taiwan (a high-income East Asian economy with advanced semiconductor and electronics export sectors and proactive blockchain governance frameworks).

A total of 284 firms were recruited through national exporters' associations, trade finance banking partners, and blockchain network operator referrals. The panel comprised 97 South African firms, 101 Indian firms, and 86 Taiwanese firms. Within the observation period, 149 firms adopted a blockchain trade finance platform (treatment group) and 135 firms did not adopt (control group). Adoption timing varied across firms, with 48 firms adopting in 2022, 63 in 2023, and 38 in 2024, providing the staggered adoption structure required for DiD identification. Quarterly outcome data were extracted from firms' trade finance records with written consent, supplemented by bank-provided letter of credit transaction data under data sharing agreements. Semi-structured interviews were conducted with chief financial officers or heads of trade finance at 36 purposively selected firms post-adoption.

3.5. Outcome Variables and Measures

Three primary outcome variables were specified. Trade document processing time was measured in business days from document presentation to acceptance or payment release, extracted from bank transaction records. Letter of credit discrepancy rate was measured as the proportion of first-presentation letter of credit submissions containing at least one discrepancy requiring amendment or resubmission, calculated quarterly at the firm level. Inter-firm trust was measured using a validated 12-item scale adapted from Dyer and Chu (2003), administered annually to a nominated senior trade relationship manager at each firm. The scale captures contractual, competence, and goodwill trust dimensions and demonstrated a Cronbach's alpha of 0.88 in the pilot administration.

Moderating variables included absorptive capacity, measured using a six-item scale adapted from Cohen and Levinthal (1990) and capturing IT capability, staff training investment, and prior digital system adoption; and regulatory clarity, measured using a four-item scale capturing the perceived clarity and consistency of national blockchain regulatory guidance. Control variables included firm size (log of annual revenue), export intensity (exports as a proportion of total revenue), trade corridor (intra-regional vs. intercontinental), commodity category, and years of blockchain experience.

3.6. Analytical Strategy

The primary quantitative method was two-way fixed effects DiD estimation, implemented in Stata 17 with firm and time fixed effects and standard errors clustered at the firm level. The parallel trends assumption was tested by examining pre-adoption trends in outcome variables between eventual adopters and non-adopters, and event study plots were generated to visualize dynamic treatment effects across quarters relative to adoption. For the trust outcome, which was measured annually rather than quarterly, a first-difference specification was employed. Heterogeneous treatment effects by absorptive capacity and regulatory clarity were estimated through interaction terms in the main DiD specification.

Effect sizes for continuous outcomes were reported as percentage changes (for processing time and discrepancy rates) and Cohen's d (for trust scores) to facilitate cross-study comparability. Robustness checks included alternative control group specifications, the exclusion of early adopters, and placebo tests using pre-adoption periods as falsification exercises. Semi-structured interview data were analyzed using directed content analysis (Hsieh & Shannon, 2005), with an a priori code scheme derived from the theoretical framework supplemented by inductively generated codes. Analysis was conducted using MAXQDA 2024.

IV. RESULTS

4.1. Sample Characteristics

The 284 panel firms spanned a range of export sectors: electronics and technology (28.5%), agricultural commodities and food processing (22.9%), chemicals and pharmaceuticals (18.7%), textiles and apparel (17.3%), and other manufactured goods (12.7%). Firm size ranged from medium enterprises with annual revenues of approximately USD 1 million to large corporations with revenues exceeding USD 500 million, with a median annual revenue of USD 12.4 million. Mean export intensity was 64.3% of total revenue (SD = 18.7%). Pre-adoption baseline comparisons between eventual adopters and non-adopters showed no statistically significant differences on firm size, export intensity, or sector composition, supporting the comparability of the two groups.

4.2. Parallel Trends Validation

Event study plots of pre-adoption trends in document processing time and discrepancy rates showed no statistically significant pre-treatment differences between adopters and non-adopters across the four quarters preceding adoption (all p values greater than 0.10). The parallel trends assumption was therefore deemed satisfied, supporting the validity of the DiD identification strategy. Placebo tests using a falsified adoption date two quarters prior to actual adoption yielded null results, providing additional confidence in the causal interpretation of post-adoption estimates.

4.3. Effect on Document Processing Time

The DiD estimate for the effect of blockchain adoption on trade document processing time was negative and highly significant (beta = -3.84 business days, SE = 0.47, $p < 0.001$), representing a reduction of 61.4% relative to the pre-adoption mean of 6.25 business days. This result supports H1. Dynamic event study estimates confirmed that the reduction emerged immediately following adoption and was sustained and slightly amplifying across the post-adoption observation period, with the largest effects observed 6 to 8 quarters post-adoption. Country-disaggregated estimates showed reductions of 64.1% in

Taiwan, 62.3% in India, and 57.8% in South Africa, with the smaller South African effect partially attributable to lower initial blockchain network density in that market.

4.4. Effect on Letter of Credit Discrepancy Rates

Blockchain adoption was associated with a 44.2 percentage point reduction in letter of credit discrepancy rates (beta = -0.442, SE = 0.063, $p < 0.001$), supporting H2. Pre-adoption discrepancy rates averaged 68.3% in the treatment group, consistent with global industry benchmarks, and declined to a post-adoption mean of 24.1%. The discrepancy reduction was largest for firms operating on trade corridors with the highest counterparty blockchain adoption rates, consistent with the network externalities hypothesis: the efficiency gains from smart contract automation are maximized when all parties to a transaction are on the same distributed ledger. Robustness checks using alternative DiD specifications, including the stacked DiD approach of Cengiz et al. (2019) to address potential heterogeneity bias in the standard two-way fixed effects estimator, confirmed the stability of the primary estimate.

4.5. Effect on Inter-Firm Trust

Annual trust scores increased significantly following blockchain adoption, with a DiD estimate of 0.84 scale points on the 5-point composite trust measure (SE = 0.19, $p < 0.001$, Cohen's d = 0.79), providing strong support for H3. Disaggregation by trust dimension revealed that the largest gains were on the contractual trust sub-scale (d = 0.91), reflecting enhanced confidence in counterparty compliance enabled by smart contract enforcement, followed by competence trust (d = 0.74) and goodwill trust (d = 0.63). The goodwill trust finding is particularly notable, as it suggests that the transparency and accountability mechanisms of blockchain extend beyond procedural compliance to affect more dispositional and relational dimensions of trust.

4.6. Moderation Analysis

The interaction between blockchain adoption and absorptive capacity was positive and significant for both document processing time reduction (beta = 0.18, $p < 0.05$) and discrepancy rate reduction (beta = 0.21, $p < 0.05$), supporting H4. Firms with higher absorptive capacity, indicated by prior digital system adoption and staff IT training investment, achieved larger efficiency gains from blockchain adoption. The interaction between adoption and regulatory clarity was significant for the trust outcome (beta = 0.27, $p < 0.01$), supporting H5: firms operating under clearer national blockchain regulatory frameworks reported larger trust improvements, potentially because regulatory certainty reduces the perceived legal risk of committing to blockchain-mediated contractual arrangements.

4.7. Interview Findings

Directed content analysis of the 36 post-adoption interviews generated three primary thematic clusters: realized operational benefits, persistent implementation barriers, and evolving perceptions of trust and transparency.

4.7.1. Theme 1: Realized Operational Benefits

Interview participants uniformly affirmed the quantitative findings, describing blockchain adoption as a transformative operational event. Heads of trade finance at Taiwanese electronics firms emphasized that smart contract automation had effectively eliminated the internal compliance review step for standard letter of credit verification, freeing specialist staff for higher-value relationship and risk management activities. Indian pharmaceutical exporters highlighted the provenance documentation capability of distributed ledgers as particularly valuable in regulated markets where chain-of-custody verification is mandatory, reducing customs clearance delays and regulatory audit burdens simultaneously.

4.7.2. Theme 2: Persistent Implementation Barriers

Three barriers recurred prominently across country and sector contexts. First, interoperability between competing blockchain trade finance platforms (we.trade, Contour, Marco Polo, and national variants) was universally cited as a structural limitation, with several firms describing parallel documentation processes maintained to accommodate counterparties on different networks. This finding is consistent with Kouhizadeh et al. (2021), who identified network fragmentation as the primary systemic risk to blockchain's scaling potential in trade finance. Second, legacy enterprise resource planning system integration costs were described as unexpectedly high, with several medium-sized South African firms noting that integration investments exceeded initial platform licensing costs by a factor of two to three. Third, regulatory uncertainty, particularly in India where the legal status of smart contract-executed payment obligations had not been definitively settled at the time of adoption, created organizational hesitancy and, in two cases, delayed full operational deployment.

4.7.3. Theme 3: Evolving Perceptions of Trust and Transparency

The trust theme yielded the most nuanced qualitative findings. Most participants described an initial period of heightened anxiety during which the novelty of algorithm-mediated transaction processing generated uncertainty rather than confidence, consistent with Lumineau et al. (2021). Over time, however, as the system's reliability became empirically demonstrable through successful transaction cycles, participants described a qualitative shift toward what several termed a new normal of operational confidence. Several interviewees noted that blockchain's transparency had created unexpected positive relational dynamics with long-standing trade partners, with shared access to real-time shipment and documentation data described as having strengthened communication frequency and mutual accountability beyond formal contractual requirements.

V. Discussion

The findings of this study make four distinct contributions to the blockchain trade finance literature. First, the DiD estimates of a 61.4% reduction in document processing time and a 44.2 percentage point reduction in letter of credit discrepancy rates represent the most rigorous causal evidence to date on blockchain's operational efficiency effects in trade finance, extending and substantiating prior case-based estimates from the practitioner literature (HSBC, 2018; Contour, 2020) to a multi-country enterprise panel context. The consistency of these findings across South Africa, India, and Taiwan, three countries with markedly different institutional environments, strengthens confidence in the generalizability of blockchain's efficiency benefits.

Second, the trust findings (H3 supported, Cohen's d = 0.79) represent a theoretically significant contribution. Most prior blockchain adoption research treats trust as an antecedent of adoption rather than as an outcome. This study demonstrates that adoption generates trust improvements that are not merely procedural but extend to the goodwill and competence dimensions of inter-firm trust. This finding enriches Lumineau et al.'s (2021) framework by providing empirical evidence that technology-mediated trust, once operationally established, can reinforce and augment relational trust rather than displacing it. The practical implication is that blockchain adoption may generate positive relational externalities beyond the direct efficiency gains documented in quantitative metrics.

Third, the moderation findings extend the theoretical framework by demonstrating that blockchain's benefits are not uniformly distributed. Firms with higher absorptive capacity and those operating under clearer regulatory frameworks capture significantly larger efficiency and trust gains. This finding aligns with Cohen and Levinthal (1990) and supports the policy implication that investment in blockchain adoption programs should be accompanied by parallel investment in firm-level digital capabilities and regulatory framework development. Without these complementary investments, the efficiency and trust potential of blockchain will be unevenly captured and the technology's contribution to cross-border trade democratization will remain limited.

Fourth, the qualitative evidence on interoperability barriers provides important context for interpreting the quantitative findings. The efficiency gains documented in this study were achieved despite, not because of, a resolved interoperability landscape. As blockchain trade finance networks mature and standards bodies including the International Chamber of Commerce and the International Organization for Standardization (ISO) develop common data standards, the efficiency ceiling for blockchain-enabled trade finance is likely to be substantially higher than current evidence suggests.

VI. CONCLUSION

This study provides the most methodologically rigorous multi-country evidence to date that blockchain technology adoption in trade finance generates substantial and causally identified improvements in document processing efficiency, letter of credit accuracy, and inter-firm trust among emerging market exporters. The findings are robust to multiple specification checks and are consistent across South Africa, India, and Taiwan, three countries representing diverse institutional and regulatory environments.

For enterprise managers, the study establishes a compelling business case for blockchain trade finance adoption, particularly for firms operating on high-volume corridors with counterparties willing to co-adopt. The evidence on absorptive capacity as a moderator argues for strategic investment in IT infrastructure and staff training as preconditions for maximizing adoption returns. Firms considering adoption should conduct a thorough assessment of counterparty platform compatibility to avoid the productivity costs of parallel documentation processes.

For financial institutions and trade finance intermediaries, the findings suggest that blockchain adoption can significantly reduce the operational costs of letter of credit processing while enhancing client relationships through transparency and reliability improvements. However, institutions must invest in interoperability solutions and client onboarding support to ensure that efficiency gains are not confined to transactions between technologically sophisticated counterparties.

For policymakers and trade facilitation bodies, the regulatory clarity moderation finding argues strongly for the prioritization of clear, proportionate blockchain governance frameworks. Countries that provide definitive legal recognition of smart contract enforceability, distributed ledger document equivalence, and data sovereignty provisions will enable their exporting enterprises to capture the full efficiency dividend of blockchain trade finance adoption. Regional harmonization of blockchain trade finance standards, particularly within the AfCFTA, ASEAN, and South Asian Association for Regional Cooperation frameworks, deserves urgent attention.

This study carries several limitations that delineate directions for future research. The panel, while representing three geographically and institutionally diverse countries, does not include Latin America, the Middle East, or Southeast Asia, and future multi-regional studies should extend geographic coverage. The study examined adoption outcomes at the enterprise level, and future research should investigate how blockchain-generated efficiency gains propagate through supply chains to affect smaller tier-two and tier-three suppliers. Finally, the long-run implications of technology-mediated trust for relational governance in trade finance warrant sustained longitudinal investigation as blockchain ecosystems mature.

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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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Influencer Credibility, Brand Trust, and Impulsive Purchase Intention in Social Commerce: A Cross-Generational Investigation Across Emerging Markets

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Abstract

Social commerce platforms integrating peer recommendation, influencer content, and seamless in-app purchasing have fundamentally restructured consumer decision-making processes across emerging markets, where mobile-first internet adoption and youthful demographic profiles amplify the behavioral reach of influencer-mediated commerce. Despite rapid market growth, the mechanisms through which influencer credibility translates into brand trust, and subsequently into impulsive purchase intention, remain incompletely theorized and insufficiently tested across generational cohorts and cultural contexts in developing economies. This study develops and tests an integrated model grounded in the Elaboration Likelihood Model, Source Credibility Theory, and Stimulus-Organism-Response framework to examine how influencer expertise, trustworthiness, and parasocial relationship intensity shape brand trust and impulsive purchase intention among Generation Z and Millennial consumers in Egypt, Indonesia, and Nigeria. Drawing on survey data from 624 active social commerce users and employing covariance-based structural equation modeling (CB-SEM) with multi-group analysis, the study finds that influencer trustworthiness exerts the strongest effect on brand trust (beta = 0.49, $p < 0.001$), which fully mediates the relationship between all influencer credibility dimensions and impulsive purchase intention. Parasocial relationship intensity significantly moderates the trustworthiness-brand trust relationship (beta = 0.26, $p < 0.01$). Generation Z consumers demonstrate significantly stronger parasocial relationship effects than Millennials, while cultural tightness-looseness moderates the relative weight of expertise versus trustworthiness pathways across the three national samples. The study contributes to social commerce, consumer behavior, and influencer marketing literatures and offers actionable recommendations for brand managers, platform operators, and marketing regulators in emerging market contexts.

Keywords: - Influencer Marketing, Social Commerce, Brand Trust, Impulsive Purchase Intention, Source Credibility Theory, Elaboration Likelihood Model, Parasocial Relationships, Generation Z, Emerging Markets

I. INTRODUCTION

The convergence of social media, mobile commerce, and creator economy business models has produced a structurally novel commercial ecosystem in which individual content creators, commonly designated as influencers, serve as the primary trust intermediaries between brands and consumers (De Veirman et al., 2017). The global influencer marketing industry was estimated to exceed USD 21 billion in annual expenditure in 2023, with emerging markets in Africa, Southeast Asia, and the Middle East and North Africa region accounting for a rapidly growing share of both investment and audience reach (Statista, 2024). In Egypt, Indonesia, and Nigeria, three of the most populous and youngest-demographic emerging economies globally, social media penetration rates have accelerated dramatically since 2018, with TikTok, Instagram, YouTube, and local platforms such as Kwesé and Tokopedia Live hosting influencer-driven commerce ecosystems that increasingly blur the boundary between content consumption and retail transaction.

The commercial logic of influencer marketing rests on the proposition that consumers transfer trust from admired and credible individuals to the brands and products those individuals endorse, reducing the perceived risk of unfamiliar brand engagement and accelerating purchase decisions through parasocial identification mechanisms (Ohanian, 1990). This trust transfer is theorized to be particularly potent in social commerce environments, where peer-generated content, real-time interaction, and frictionless in-app purchasing combine to create conditions of heightened emotional engagement and reduced deliberative processing (Phan et al., 2020). However, the precise mechanisms through which influencer attributes, audience psychology, and platform architecture jointly determine downstream brand and purchase outcomes remain inadequately specified in the empirical literature, particularly for developing economy consumers navigating rapidly evolving digital retail environments.

Generational heterogeneity represents a theoretically important but empirically underexplored dimension of influencer marketing effectiveness. Generation Z consumers, broadly defined as those born between 1997 and 2012, represent the first truly digital-native generation and constitute the primary audience for short-form video and live commerce platforms in all three study countries (Francis & Hoefel, 2018). Their consumption of social media content, including influencer-generated material, is characterized by higher duration, greater platform diversity, and stronger parasocial relationship formation than older cohort consumers, suggesting that influencer credibility mechanisms may operate with different intensity and through different pathways across generational groups. Comparative generational analysis of influencer marketing effectiveness has been limited in the academic literature and has been concentrated in advanced economy samples.

Cultural context further complicates the picture. Hofstede et al.'s (2010) cultural dimensions framework, and particularly the tightness-looseness dimension developed by Gelfand et al. (2011), predicts that consumers in tighter cultural environments characterized by strong social norms and lower tolerance for deviance may rely more heavily on influencer expertise signals as proxies for normative product selection, while consumers in looser cultural contexts may weight personal trustworthiness and relational authenticity more heavily. Testing these cultural moderation hypotheses across Egypt, Indonesia, and Nigeria, which vary meaningfully on tightness-looseness and other relevant cultural dimensions, provides an opportunity to advance the cross-cultural consumer behavior literature.

This study is organized around three research questions:

- Through what mechanisms do influencer expertise, trustworthiness, and parasocial relationship intensity influence brand trust and impulsive purchase intention among social commerce users in emerging markets?
- Do these mechanisms differ significantly across Generation Z and Millennial consumer cohorts?
- Does cultural tightness-looseness moderate the relative effectiveness of expertise versus trustworthiness pathways in the influencer-brand trust relationship?

The paper proceeds as follows. Section 2 develops the theoretical framework and reviews the relevant literature. Section 3 describes the research methodology. Section 4 presents the empirical findings. Section 5 discusses implications. Section 6 concludes with recommendations and limitations.

II. LITERATURE REVIEW

2.1. Source Credibility Theory and Influencer Effectiveness

Source Credibility Theory, originally developed by Hovland et al. (1953) in the context of mass communication persuasion research, proposes that the persuasive effectiveness of a communication depends on the perceived credibility of the source, operationalized primarily through two dimensions: expertise (the extent to which the communicator is perceived as knowledgeable about the subject matter) and trustworthiness (the extent to which the communicator is perceived as honest and unbiased). Ohanian (1990) extended this framework to advertising contexts and added attractiveness as a third credibility dimension, validating a three-factor scale that has become the standard measurement instrument in source credibility research. Applied to influencer marketing, Source Credibility Theory predicts that influencers perceived as highly knowledgeable about their endorsed product categories and personally trustworthy in their recommendations will generate stronger attitudinal and behavioral effects on their audiences than less credible communicators. Empirical evidence broadly supports these predictions. Lou and Yuan (2019) demonstrated that influencer informativeness and trustworthiness were the dominant predictors of follower purchase intention on Instagram, with expertise showing particularly strong effects in the beauty and fashion categories. Djafarova and Rushworth (2017) found through qualitative research that Instagram influencer effectiveness was primarily driven by perceived authenticity and relatability rather than celebrity status, suggesting that parasocial intimacy functions as a trust amplifier that interacts with formal credibility dimensions.

2.2. The Elaboration Likelihood Model and Social Commerce Processing

The Elaboration Likelihood Model (ELM), developed by Petty and Cacioppo (1986), provides a complementary theoretical lens for understanding influencer marketing effectiveness. ELM distinguishes between the central route to persuasion, characterized by careful evaluation of argument quality and substantive content, and the peripheral route, characterized by reliance on heuristic cues including source attractiveness, social proof, and emotional appeals. The model predicts that motivation and ability to process information determine which route dominates in any given consumption context. Social commerce environments are characterized by conditions that systematically favor peripheral processing: high content volume, rapid scrolling consumption, ambient notification interruption, and the emotional activation generated by aspirational lifestyle content all reduce the cognitive resources available for central route evaluation (Xu et al., 2017). Under these conditions, influencer credibility cues function as peripheral heuristics that substitute for systematic product evaluation, enabling rapid trust transfer to endorsed brands. This theoretical prediction implies that influencer effectiveness in social

commerce may operate primarily through affect-laden trust and identification mechanisms rather than through deliberative attitude formation, with brand trust serving as the critical mediating construct.

2.3. Parasocial Relationships and Their Commercial Implications

Parasocial relationships, originally conceptualized by Horton and Wohl (1956) as the one-sided intimacy that media audiences develop toward performers they perceive as personally familiar, have attracted growing attention in the influencer marketing literature as a mechanism explaining the unusual persuasive effectiveness of social media creators relative to traditional celebrity endorsers. Unlike celebrity endorsement, which typically involves formal promotional contracts and clearly commercial intent, influencer content is embedded in ongoing personal narrative streams that create an illusion of genuine friendship and shared experience between creator and follower (Chapple and Cownie, 2017).

Empirical evidence links parasocial relationship intensity to enhanced influencer credibility perception, brand attitude transfer, and purchase behavior. Yuan and Lou (2020) demonstrated that parasocial relationship strength significantly amplified the effect of influencer trustworthiness on consumer brand attitude in a Chinese social commerce context. Kim and Song (2016) showed that parasocial interaction with YouTube creators predicted brand advocacy and repeat engagement beyond general attitude measures. The parasocial mechanism is theoretically amplified in Generation Z consumers, who spend substantially more time in parasocial digital relationship contexts and develop more elaborated parasocial bonds with micro and nano-influencers than older cohort consumers (Francis and Hoefel, 2018).

2.4. Impulsive Purchase Behavior in Social Commerce

Impulsive purchasing, defined as unplanned buying behavior triggered by sudden and compelling stimuli encountered in a commercial environment, has been extensively studied in brick-and-mortar retail contexts but has gained renewed scholarly attention as social commerce platforms create new architectures of impulse trigger and friction reduction (Verhagen and van Dolen, 2011). The Stimulus-Organism-Response (SOR) framework, adapted from environmental psychology, provides a useful organizing model: external stimuli in the social commerce environment (influencer content, limited-time offers, visual product displays) activate internal organism states (emotional arousal, brand trust, purchase urge) that culminate in purchase responses.

In emerging market social commerce contexts, impulsive purchasing has been shown to be particularly prevalent among mobile-first, social-media-heavy consumer populations. Chen and Yao (2018) documented significantly higher impulsive purchase rates on live commerce platforms compared to static e-commerce, attributing this to the real-time social pressure, scarcity signals, and influencer-generated emotional contagion that characterize the live format. Wongkitrungrueng and Assarut (2018) found in a Thai social commerce context that seller trust was the primary antecedent of impulsive purchase intention, with live interaction quality and perceived product authenticity as significant secondary predictors, confirming the centrality of trust in the social commerce purchase decision.

2.5. Cultural Dimensions and Cross-Cultural Consumer Behavior

The tightness-looseness cultural dimension, operationalized by Gelfand et al. (2011) as the degree to which a society has strong social norms and sanctions for deviance, offers theoretically grounded predictions about cross-cultural variation in influencer marketing reception. Tighter cultures, where conformity to social norms is more strongly enforced, may generate stronger reliance on influencer expertise as a norm-sanctioned guide to appropriate consumption choices, given the social risk of product selection errors in high-conformity environments. Looser cultures, where individual self-expression and personal choice are more normatively valued, may generate stronger reliance on influencer trustworthiness and authentic personality congruence as the primary trust drivers.

Of the three study countries, Egypt scores highest on cultural tightness (Gelfand et al., 2011), followed by Indonesia, with Nigeria exhibiting the most diverse regional variation but a comparatively looser national cultural profile. This ordering generates testable predictions about the relative effectiveness of expertise versus trustworthiness pathways that have not previously been examined using empirical social commerce data from these three national contexts.

2.6. Research Gaps

Five gaps in the existing literature motivate this study. First, cross-country studies simultaneously testing Source Credibility Theory, ELM, and parasocial relationship mechanisms within a unified structural model are absent from the influencer marketing literature. Second, generational comparison of influencer marketing mechanisms using CB-SEM multi-group analysis has not been conducted in any emerging market context. Third, the cultural tightness-looseness dimension has not been empirically tested as a moderator of influencer credibility pathway effectiveness. Fourth, the mediating role of brand trust in the influencer-purchase intention relationship has been posited theoretically but rarely tested with full mediation specification in emerging market social commerce samples. Fifth, Egypt, Nigeria, and Indonesia have been individually understudied in influencer marketing research, and no cross-national study has compared all three simultaneously.

III. RESEARCH METHODOLOGY

3.1. Research Design

A quantitative cross-sectional survey design was employed as the primary method, implemented through online self-administered questionnaires distributed to active social commerce users in Egypt, Indonesia, and Nigeria. Covariance-based structural equation modeling (CB-SEM) was selected as the analytical method in preference to PLS-SEM because the study's theoretical model specifies reflective measurement structures and is oriented toward theory testing rather than prediction maximization, contexts in which CB-SEM's stricter distributional assumptions and superior goodness-of-fit diagnostics are

advantageous (Hair et al., 2019). Multi-group analysis using the chi-square difference test and the measurement invariance testing procedure of Vandenberg and Lance (2000) was employed for generational and cross-national comparative analysis. A secondary qualitative component involving 18 focus group discussions augmented the structural findings with contextual and experiential depth.

3.2. Research Objectives

The study was guided by the following specific objectives:

- Objective 1: To assess the direct effects of influencer expertise, trustworthiness, and attractiveness on brand trust among social commerce users in Egypt, Indonesia, and Nigeria.
- Objective 2: To test the mediating role of brand trust in the relationship between influencer credibility dimensions and impulsive purchase intention.
- Objective 3: To examine parasocial relationship intensity as a moderator of the trustworthiness-brand trust relationship.
- Objective 4: To conduct cross-generational multi-group analysis comparing Generation Z and Millennial consumer pathways.
- Objective 5: To test cultural tightness-looseness as a country-level moderator of expertise versus trustworthiness pathway effectiveness.

3.3. Hypotheses

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

- H1: Influencer expertise is positively associated with brand trust.
- H2: Influencer trustworthiness is positively associated with brand trust.
- H3: Influencer attractiveness is positively associated with brand trust.
- H4: Brand trust is positively associated with impulsive purchase intention.
- H5: Brand trust fully mediates the relationship between each influencer credibility dimension and impulsive purchase intention.
- H6: Parasocial relationship intensity positively moderates the relationship between influencer trustworthiness and brand trust.
- H7: Generation Z consumers exhibit significantly stronger parasocial relationship moderation effects than Millennial consumers.
- H8: Cultural tightness moderates the relative strength of the expertise pathway relative to the trustworthiness pathway in the influencer credibility-brand trust relationship.

3.4. Sample and Data Collection

The target population comprised adults aged 18 to 42 years who had made at least one purchase through a social commerce platform, defined as a purchase directly initiated or significantly influenced by social media influencer content, in the three months preceding the survey. Age eligibility was defined to capture both Generation Z (born 1997 to 2012, aged 18 to 28 at the time of data collection in mid-2025) and Millennial (born 1981 to 1996, aged 29 to 42) consumers within a single instrument.

Egypt, Indonesia, and Nigeria were selected to represent the Middle East and North Africa, Southeast Asia, and Sub-Saharan Africa respectively, and to provide the cross-cultural variation in tightness-looseness scores necessary to test H8. Data collection was conducted through online panel providers with established access to social media-active consumer populations in each country. Quota sampling ensured approximately equal representation of Generation Z and Millennial respondents and balanced gender representation. After removal of incomplete responses and failed attention check items, the final sample comprised 624 respondents: 214 from Egypt, 208 from Indonesia, and 202 from Nigeria. Of these, 52.4% were Generation Z and 47.6% were Millennials. Female respondents constituted 54.3% of the sample. The most frequently used platforms were Instagram (62.8%), TikTok (57.4%), YouTube (44.2%), and WhatsApp Commerce (38.6%).

3.5. Measures and Instruments

The survey instrument comprised six sections. Influencer expertise was measured using four items adapted from Ohanian (1990), assessing the perceived knowledge, competence, experience, and qualification of the respondent's primary followed influencer in their most recent social commerce purchase context. Influencer trustworthiness was assessed using five items adapted from Ohanian (1990) and updated for social media contexts following Lou and Yuan (2019), capturing perceived honesty, sincerity, disclosure transparency, and endorsement authenticity. Influencer attractiveness was measured using three items assessing physical and personality-based attractiveness perceptions. Parasocial relationship intensity was measured using eight items adapted from the Parasocial Interaction Scale of Rubin et al. (1985) and updated for social media contexts by Yuan and Lou (2020), capturing friendship-like familiarity, emotional engagement, and simulated social presence with the primary followed influencer.

Brand trust was assessed using six items adapted from Chaudhuri and Holbrook (2001), capturing both cognitive trust, reflecting confidence in brand reliability, and affective trust, reflecting emotional security and comfort with the brand. Impulsive purchase intention was measured using five items adapted from Verhagen and van Dolen (2011), capturing purchase urge intensity, spontaneity, and lack of prior planning. All items were anchored on seven-point Likert scales from 1 (strongly disagree) to 7 (strongly agree). Platform usage frequency, product category (fashion and beauty, food and beverage, consumer electronics, home goods, and other), and monthly social commerce expenditure were collected as control variables.

Instrument translation employed a committee approach with independent forward and back translation by bilingual academics in each country, followed by cognitive debriefing with ten participants per country to verify comprehension equivalence. A pilot study with 72 respondents confirmed Cronbach's alpha values ranging from 0.79 to 0.91 across all constructs.

3.6. Analytical Strategy

CB-SEM was implemented using IBM AMOS 29. The measurement model was assessed through confirmatory factor analysis (CFA) evaluating indicator loadings, composite reliability, average variance extracted, and discriminant validity using the Fornell and Larcker (1981) criterion. Full measurement invariance across generational and national groups was tested sequentially: configural invariance, metric invariance, and scalar invariance, before proceeding to structural group comparisons. The structural model was evaluated using maximum likelihood estimation with bootstrapped confidence intervals for indirect effects using 5,000 bootstrap samples.

Moderation by parasocial relationship intensity was tested by introducing product indicator interaction terms following the procedures recommended by Marsh et al. (2004) for latent variable interaction in CB-SEM. Generational and cross-national moderation was assessed through multi-group CFA and structural comparison using the chi-square difference test. Cultural tightness-looseness scores at the national level were incorporated as contextual moderators using a product of path coefficient differences across country groups, with Egypt assigned a tightness score of 5.6, Indonesia 4.9, and Nigeria 3.8, following Gelfand et al. (2011). Focus group data were analyzed using thematic analysis with a deductive theoretical framework supplemented by emergent inductive codes.

IV. RESULTS

4.1. Measurement Model

CFA results confirmed adequate model fit: chi-square/df = 2.14, CFI = 0.95, TLI = 0.94, RMSEA = 0.043 (90% CI: 0.036 to 0.051), SRMR = 0.051. All indicator loadings exceeded 0.65, ranging from 0.67 to 0.88. Composite reliability values ranged from 0.84 to 0.93, and AVE values from 0.54 to 0.72, confirming convergent validity. The Fornell and Larcker criterion was satisfied for all construct pairs, with the square root of each construct's AVE exceeding all inter-construct correlations. Common method bias was assessed through Harman's single-factor test, yielding a maximum single-factor variance of 24.7%, below the 50% threshold. Sequential measurement invariance testing confirmed full metric invariance across both generational groups and all three national samples, validating cross-group structural comparisons.

4.2. Structural Model and Hypothesis Testing

The structural model demonstrated good fit: chi-square/df = 2.31, CFI = 0.94, TLI = 0.93, RMSEA = 0.046, SRMR = 0.058. The model explained 61.3% of the variance in brand trust and 47.8% of the variance in impulsive purchase intention. Influencer trustworthiness exerted the strongest direct effect on brand trust (beta = 0.49, SE = 0.06, t = 8.17, $p < 0.001$), supporting H2. Influencer expertise had a significant positive effect (beta = 0.31, SE = 0.07, t = 4.43, $p < 0.001$), supporting H1. Influencer attractiveness showed a significant but smaller effect (beta = 0.18, SE = 0.06, t = 3.00, $p < 0.01$), supporting H3. Brand trust had a strong positive effect on impulsive purchase intention (beta = 0.58, SE = 0.07, t = 8.29, $p < 0.001$), supporting H4.

Mediation analysis supported H5: bootstrap confidence intervals confirmed full mediation of the expertise-purchase intention relationship through brand trust (indirect effect = 0.180, 95% CI: 0.112 to 0.254), full mediation of the trustworthiness-purchase intention relationship (indirect effect = 0.284, 95% CI: 0.198 to 0.371), and full mediation of the attractiveness-purchase intention relationship (indirect effect = 0.104, 95% CI: 0.051 to 0.163). The direct effects of all three credibility dimensions on impulsive purchase intention were non-significant after controlling for brand trust, confirming full mediation. This finding indicates that influencer credibility attributes generate purchase behavior exclusively through the brand trust mechanism, with no residual direct persuasion pathway.

4.3. Parasocial Relationship Moderation

The latent variable interaction between parasocial relationship intensity and influencer trustworthiness was positive and significant in predicting brand trust (beta = 0.26, SE = 0.09, t = 2.89, $p < 0.01$), supporting H6. The interaction between parasocial relationship intensity and influencer expertise was non-significant (beta = 0.09, $p = 0.18$), suggesting that parasocial bonds specifically amplify the trust-generating capacity of relational authenticity cues but do not similarly amplify expertise-based credibility. Slope analysis revealed that the trustworthiness-brand trust relationship was nearly twice as strong among high parasocial intensity respondents compared to low parasocial intensity respondents, a practically significant amplification consistent with the theoretical prediction that parasocial intimacy heightens susceptibility to trust transfer from credible relational sources.

4.4. Generational Multi-Group Analysis

Structural multi-group analysis comparing Generation Z and Millennial subsamples confirmed significant path coefficient differences for two of the eight specified structural paths. The parasocial relationship moderation effect was significantly stronger in Generation Z consumers (interaction beta = 0.38) than in Millennials (interaction beta = 0.17), with the chi-square difference test confirming significance (delta chi-square = 7.84, df = 1, $p < 0.01$), supporting H7. The trustworthiness-brand trust path was also significantly stronger in Generation Z (beta = 0.56) than Millennials (beta = 0.41, delta chi-square = 5.92, df = 1, $p < 0.05$), consistent with the higher parasocial engagement of digital-native consumers and their greater reliance on perceived authenticity over formal expertise credentials in influencer evaluation. No significant

generational differences were found for the expertise-brand trust or brand trust-purchase intention paths, suggesting that the fundamental trust-to-purchase mechanism is generationally stable while the inputs to trust formation differ across cohorts.

4.5. Cross-National Cultural Moderation

Structural path comparison across the three national samples revealed a pattern consistent with the cultural tightness-looseness moderation hypothesis (H8). The expertise-brand trust path was strongest in Egypt (beta = 0.41), intermediate in Indonesia (beta = 0.33), and smallest in Nigeria (beta = 0.22), following the descending tightness-looseness order. Conversely, the trustworthiness-brand trust path was weakest in Egypt (beta = 0.43), intermediate in Indonesia (beta = 0.49), and strongest in Nigeria (beta = 0.56). The product moment correlation between country tightness scores and expertise path coefficients was $r = 0.997$, and between tightness scores and trustworthiness path coefficients $r = -0.989$, providing near-perfect alignment with the cultural moderation prediction. Chi-square difference tests confirmed that the Egypt-Nigeria pairwise differences on both paths were statistically significant ($p < 0.05$), supporting H8.

4.6. Focus Group Findings

Thematic analysis of the 18 focus group discussions across the three countries generated four thematic domains: the meaning and boundaries of influencer authenticity, platform architecture as an impulse trigger, the social currency of influencer-endorsed brands, and generational negotiation of skepticism and trust.

4.6.1. Theme 1: The Meaning and Boundaries of Influencer Authenticity

Authenticity emerged as the dominant evaluative criterion across all three national samples, though its meaning varied. Egyptian participants defined authenticity primarily through expertise demonstration, citing detailed product knowledge, professional background disclosure, and willingness to acknowledge product limitations as the markers distinguishing credible influencers from promotional actors. Indonesian participants emphasized community embeddedness, valuing influencers who visibly shared cultural contexts, local values, and everyday experiences with their audiences. Nigerian participants placed the greatest emphasis on personal integrity and avoiding over-commercialization, describing a threshold beyond which excessive sponsored content damaged an influencer's trustworthiness regardless of content quality. These nationally distinct authenticity constructions map closely onto the cultural tightness-looseness moderation finding, providing qualitative grounding for the quantitative cross-national path coefficient differences.

4.6.2. Theme 2: Platform Architecture as an Impulse Trigger

Participants across all generational cohorts described specific platform design features as active agents in their purchase decision processes. TikTok Shop's one-tap purchase integration, Instagram's shoppable story stickers, and live commerce countdown timers were cited as creating purchase urgency that bypassed deliberative evaluation in ways that static display advertising never achieved. Several Generation Z participants described a habituated purchase-as-reaction pattern in which adding items to cart had become an automatic response to influencer content rather than a considered decision, with completion to payment representing the decision point rather than initial cart addition. This platformized impulse architecture is consistent with the SOR framework and suggests that platform design co-produces impulsive purchase outcomes alongside influencer content quality.

4.6.3. Theme 3: The Social Currency of Influencer-Endorsed Brands

A recurrent theme across national samples but with particular intensity among Egyptian and Indonesian participants was the social signaling value of consuming influencer-endorsed brands. Participants described influencer endorsement as conferring a quality certification that reduced the social risk of conspicuous consumption in high-conformity peer environments, consistent with the cultural tightness-looseness moderation finding. Several Indonesian participants explicitly described influencer purchase decisions as socially verifiable through shared posts and stories, creating a secondary social commerce loop in which follower purchases of influencer-endorsed brands generated social approval that reinforced brand trust and created word-of-mouth diffusion within social networks.

4.6.4. Theme 4: Generational Negotiation of Skepticism and Trust

Millennial participants consistently described more sophisticated influencer evaluation strategies than their Generation Z counterparts, including cross-referencing product claims with independent reviews, checking influencer disclosure compliance, and calibrating trust based on endorsement frequency and commercial density. Generation Z participants, while not uniformly uncritical, described faster and more instinctive trust formation processes grounded in parasocial intimacy rather than systematic credibility evaluation, consistent with the stronger parasocial moderation effects documented in the quantitative analysis. Several Millennial participants described a personal evolution from early uncritical influencer trust toward more discerning evaluation as accumulated negative experiences with misleading endorsements had shaped more skeptical consumption habits, suggesting that generational differences in influencer marketing reception may partly reflect lifecycle and experience effects as well as cohort-specific media socialization.

V. DISCUSSION

This study yields six theoretical contributions to the influencer marketing, social commerce, and cross-cultural consumer behavior literatures. First, the confirmation of full mediation of all influencer credibility dimensions through brand trust (H5 supported for all three paths) establishes that influencer marketing effectiveness operates exclusively through trust as a mediating mechanism in social commerce contexts, with no residual direct persuasion pathway. This finding resolves an ambiguity in the prior literature, where some studies have documented direct credibility effects on purchase intention without

controlling for trust, and clarifies that brand trust is the operative construct in influencer-driven commerce rather than a secondary consideration. For brand managers, this implies that influencer selection should prioritize trust-generating attributes over direct call-to-action effectiveness metrics.

Second, the dominance of influencer trustworthiness over expertise in predicting brand trust (H2 supported, beta = 0.49 versus H1 supported, beta = 0.31) confirms the relational authenticity hypothesis and extends it to emerging market social commerce contexts. This hierarchy aligns with peripheral route processing predictions from ELM: in the high-volume, low-deliberation environment of social commerce feeds, relational trust cues are more cognitively accessible and emotionally resonant than expertise evaluations that would require systematic processing. The implication for brand managers is that influencer selection criteria should weight evidence of genuine product engagement, disclosure transparency, and audience relationship quality more heavily than follower-reported expertise perceptions.

Third, the parasocial moderation finding (H6 supported, beta = 0.26) provides empirically grounded support for the theoretical proposition that parasocial relationship intensity amplifies the trust-generative capacity of influencer trustworthiness but not expertise. This specificity is theoretically informative: parasocial bonds create a relational context in which trustworthiness signals are received with heightened affective processing, generating stronger emotional trust responses. Expertise signals, which require more cognitive evaluation, are not similarly amplified by the emotional relational context of parasocial engagement. This distinction has not been previously documented in the influencer marketing literature and suggests that micro-influencers with deep parasocial audience relationships may generate disproportionately large trust effects per credibility unit relative to macro-influencers with more professional but less parasocially intense audience relationships.

Fourth, the generational amplification of parasocial moderation effects (H7 supported) adds empirical precision to the widely cited but rarely rigorously tested claim that Generation Z consumers are more susceptible to influencer marketing than Millennials. The finding that this susceptibility operates specifically through parasocial intensity amplification of trustworthiness effects, rather than through uniformly higher credibility sensitivity, provides a mechanism-level understanding that is more actionable for practitioners than the aggregate generational claim. Campaigns targeting Generation Z consumers should invest in long-format content that deepens parasocial familiarity rather than exclusively optimizing for reach and impression volume.

Fifth, the cultural tightness-looseness moderation of expertise versus trustworthiness pathway effectiveness (H8 supported) represents the first empirical validation of Gelfand et al.'s (2011) framework in an influencer marketing context and provides theoretically grounded guidance for cross-market campaign calibration. Brands operating across culturally diverse emerging markets should not apply uniform influencer selection and content strategies but should adjust the relative emphasis on expertise demonstration versus relational authenticity cultivation to match the normative compliance orientations of each cultural context.

Sixth, the qualitative documentation of platform architecture as an active impulse trigger that operates alongside influencer content quality points to an understudied design dimension of social commerce effectiveness that quantitative structural models capturing only consumer psychology cannot fully represent. Future research should incorporate platform UX design variables as explicit antecedents of impulsive purchase behavior alongside influencer and consumer psychological constructs.

VI. CONCLUSION

This study provides a theoretically integrated and empirically robust analysis of how influencer credibility dimensions generate brand trust and impulsive purchase intention across generational cohorts and cultural contexts in three major emerging markets. The finding that brand trust fully mediates all influencer-to-purchase pathways, that trustworthiness dominates expertise in trust generation, and that parasocial relationship intensity amplifies trustworthiness effects with particular strength among Generation Z consumers establishes a clear and actionable hierarchy of influencer marketing mechanisms for practitioners and regulators operating in emerging market social commerce environments.

For brand managers and marketing agencies, the study's findings argue for a trust-first influencer selection framework that prioritizes audience relationship quality metrics, disclosure compliance history, and parasocial depth indicators over reach and engagement rate metrics that dominate current industry measurement practices. In emerging markets with tight cultural environments such as Egypt, expertise demonstration content should receive greater creative investment. In looser cultural environments such as Nigeria, authentic personality expression and community integration should be prioritized. Cross-generational campaign strategies should differentiate between Generation Z executions that invest in parasocial depth and Millennial executions that address the more systematic credibility evaluation typical of that cohort.

For social commerce platform operators, the qualitative evidence on purchase architecture as an active impulse trigger raises important design ethics questions about the boundary between convenience and manipulation in one-tap purchasing integrations. Responsible platform design should ensure that consumers have meaningful opportunities for purchase reflection between cart addition and payment completion, particularly for higher-value categories where impulsive decisions are more likely to generate post-purchase regret and return costs.

For consumer protection regulators in Egypt, Indonesia, and Nigeria, the study's evidence on the full trust-mediation mechanism and generational susceptibility differences argues for strengthening mandatory influencer disclosure requirements and monitoring compliance actively. Regulators should consider whether current general advertising standards adequately address the unique trust dynamics of parasocial commerce relationships, in which the commercial nature of endorsements may be genuinely invisible to high-parasocial-intensity followers who experience influencer recommendations as friend advice rather than paid promotion.

The study has several limitations that invite future research. The cross-sectional design captures a static snapshot of a rapidly evolving market, and longitudinal tracking of how influencer-brand trust relationships evolve with platform saturation, influencer audience fatigue, and regulatory interventions would substantially enrich the field. The focus on the primary

followed influencer may understate the complexity of multi-influencer exposure in actual social commerce environments. Future research should examine the cumulative and potentially competing trust effects of multiple influencer relationships, the role of negative influencer incidents in trust erosion, and the long-term brand equity implications of influencer-mediated trust building versus destruction.

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Supply Chain Finance Adoption, Working Capital Efficiency, and Firm Profitability Among Manufacturing SMEs: Panel Evidence from Southeast Asia

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Abstract

Supply chain finance (SCF) represents a rapidly expanding set of financial instruments and platforms designed to optimize liquidity distribution across buyer-supplier networks by leveraging anchor buyer creditworthiness to extend affordable financing to supply chain participants. Despite its growing commercial prominence and its theoretical promise as a solution to working capital constraints facing manufacturing small and medium enterprises (SMEs) in developing economies, rigorous empirical evidence on the firm-level performance outcomes of SCF adoption among SMEs remains limited. This study employs a balanced panel dataset of 341 manufacturing SMEs across Thailand, Indonesia, and the Philippines over eight fiscal years from 2016 to 2023 to examine the relationship between SCF adoption, cash conversion cycle efficiency, and return on assets. Two-way fixed effects panel regression, augmented by instrumental variable estimation and dynamic GMM to address endogeneity and persistence in working capital outcomes, constitutes the primary analytical method. Results indicate that SCF adoption is associated with a statistically significant reduction in the cash conversion cycle of 18.4 days ($p < 0.001$) and an improvement in return on assets of 2.3 percentage points ($p < 0.01$). Buyer relationship quality, SCF platform digital maturity, and anchor buyer credit rating positively moderate the performance effects of SCF adoption. Qualitative evidence from 28 semi-structured interviews with SCF program managers and SME finance directors illuminates the operational mechanisms through which these gains are realized and identifies persistent barriers including collateral-free financing skepticism and platform interoperability limitations. The study contributes to the supply chain finance, working capital management, and SME finance literatures and offers actionable recommendations for banks, fintech SCF providers, and trade finance policymakers in the ASEAN region.

Keywords: - Supply Chain Finance, Working Capital Management, Cash Conversion Cycle, Manufacturing Smes, Southeast Asia, Dynamic Panel GMM, Buyer-Supplier Relationships, Fintech

I. INTRODUCTION

Working capital management occupies a central position in the financial management of manufacturing enterprises, as the efficiency with which firms manage their inventory, receivables, and payables determines their capacity to sustain operations, invest in growth, and withstand liquidity shocks (Deloof, 2003). For small and medium enterprises in manufacturing-intensive emerging economies, the working capital challenge is particularly acute. Manufacturing SMEs typically operate with thin margins, capital-intensive production processes, and asymmetric bargaining positions vis-a-vis larger anchor buyers, which frequently impose extended payment terms that stretch supplier liquidity and generate persistent financing gaps (Hofmann & Belin, 2011). The International Finance Corporation estimated the SME financing gap in emerging markets at USD 5.2 trillion annually, with working capital constraints constituting the single most frequently cited barrier to operational stability and growth investment (IFC, 2020).

Supply chain finance has emerged as a commercially and analytically significant response to this structural challenge. Unlike traditional lending, which evaluates borrower creditworthiness in isolation, SCF instruments leverage the

creditworthiness of large anchor buyers to extend more affordable and accessible financing to their suppliers through mechanisms including reverse factoring, dynamic discounting, inventory financing, and purchase order financing (Hofmann & Belin, 2011). By redistributing liquidity from capital-abundant buyers to capital-constrained suppliers, SCF programs theoretically improve working capital efficiency across the supply chain without requiring increased bank credit limits or additional collateral from SME borrowers.

The Association of Southeast Asian Nations (ASEAN) region represents a particularly consequential context for SCF development. Manufacturing SMEs constitute between 88 and 97 percent of all enterprises in ASEAN member states, collectively contributing approximately 42 percent of regional GDP and employing over 70 percent of the private sector workforce (ASEAN, 2020). The region's deep integration into global manufacturing value chains through electronics, automotive, food processing, and textiles sectors creates both a high demand for working capital financing and a structural environment in which anchor buyer creditworthiness can serve as the foundation for SCF program design. Thailand, Indonesia, and the Philippines, three of ASEAN's five largest economies, share these structural characteristics while exhibiting sufficient institutional diversity to enable meaningful cross-country comparison.

Despite SCF's growing commercial footprint, the academic literature has not kept pace with practitioner interest. Most published studies are conceptual or case-based, documenting implementation frameworks and pilot program experiences rather than estimating performance effects with appropriate controls and identification strategies (Gelsomino et al., 2016). The few quantitative studies available focus on large listed corporations rather than SMEs, and evidence from Southeast Asia is virtually absent. Critically, the endogeneity problem inherent in SCF adoption research, the possibility that better-performing firms self-select into SCF programs rather than SCF generating performance improvements, has rarely been addressed through appropriate econometric methods.

This study addresses these gaps through three research questions: (1) Does SCF adoption significantly improve cash conversion cycle efficiency and return on assets among manufacturing SMEs in Thailand, Indonesia, and the Philippines? (2) What firm-level and program-level factors moderate the performance effects of SCF adoption? (3) Through what operational mechanisms do SCF-adopting SMEs realize working capital and profitability improvements?

The paper proceeds as follows. Section 2 reviews the theoretical foundations and empirical literature on working capital management and SCF. Section 3 describes the research design, data, and analytical methods. Section 4 presents the empirical results. Section 5 discusses the findings and their implications. Section 6 concludes with recommendations and limitations.

II. LITERATURE REVIEW

2.1. Working Capital Management and Firm Performance

The relationship between working capital management efficiency and firm performance has been extensively studied since the seminal contributions of Gitman (1974), who introduced the cash conversion cycle (CCC) as a comprehensive metric for working capital efficiency. The CCC measures the net days elapsed between cash outflows for inventory procurement and cash inflows from customer collections, capturing the duration for which a firm must finance its operating cycle from internal or external sources. A shorter CCC implies lower financing costs, reduced liquidity risk, and greater operational flexibility. Shin and Soenen (1998) provided early empirical evidence that CCC was negatively correlated with firm profitability in a large US sample, a finding replicated by Deloof (2003) using Belgian data and extended to emerging markets by Padachi (2006) in Mauritius and Garcia-Teruel and Martinez-Solano (2007) in Spain.

The theoretical channels through which working capital efficiency affects profitability are well established. First, shorter receivables collection periods reduce the opportunity cost of tied-up capital and the credit risk of customer default (Richards & Laughlin, 1980). Second, leaner inventory positions reduce warehousing costs, obsolescence risk, and the financing cost of inventory investment, though Blinder and Maccini (1991) identified a just-in-time tradeoff whereby excessive inventory reduction exposes firms to stockout costs. Third, extended accounts payable terms provide cost-free short-term financing from suppliers, though Ng et al. (1999) demonstrated that early payment discount capture generates positive net present value when the discount rate exceeds the firm's cost of capital. The optimal working capital position balances these competing considerations and is firm and industry-specific.

2.2. Supply Chain Finance: Instruments, Mechanisms, and Theoretical Foundations

Supply chain finance has been defined by the Global Supply Chain Finance Forum (2016) as the use of financing and risk mitigation practices and techniques to optimize the management of the working capital and liquidity tied up in supply chain processes for collaborating business partners. The theoretical foundations of SCF draw from transaction cost economics (Williamson, 1985), relational contracting theory (Macneil, 1980), and financial intermediation theory (Diamond, 1984). Transaction cost economics frames SCF as a governance innovation that reduces the search, negotiation, and enforcement costs associated with bilateral supplier financing arrangements by embedding financing within established buyer-supplier relationships. Relational contracting theory highlights the role of trust and repeated interaction in enabling the risk-sharing arrangements that underpin SCF program design.

Reverse factoring, the most commercially prevalent SCF instrument, involves a financial intermediary offering to purchase confirmed supplier invoices at a discount reflecting the anchor buyer's credit rating rather than the supplier's own creditworthiness, and collecting payment from the buyer at the original invoice maturity date (Klapper, 2006). For SME suppliers, the financial benefit is the spread between their own financing cost, which may range from 8 to 25 percent per annum in emerging market contexts, and the anchor buyer-priced reverse factoring rate, which may be 3 to 6 percent per annum for investment-grade buyers. Hofmann and Belin (2011) documented that this spread generates substantial working capital cost savings for participating suppliers, while enabling buyers to preserve or extend payment terms without deteriorating supplier financial health.

2.3. Empirical Evidence on SCF Performance Outcomes

The empirical literature on SCF performance outcomes is growing but remains methodologically uneven. Wuttke et al. (2013) conducted a qualitative multi-case study of SCF adoption among European manufacturers and identified liquidity improvement, relationship strengthening, and supply chain risk reduction as the primary perceived benefits, while noting that quantification of benefits was rarely undertaken systematically by adopting firms. Liebl et al. (2016) analyzed survey data from 207 German firms and found that SCF program participation was associated with significantly lower working capital ratios, though the cross-sectional design precluded causal inference.

More recent quantitative contributions have made progress on identification. Caniato et al. (2019) analyzed a proprietary dataset of reverse factoring programs administered by a major European bank and documented statistically significant reductions in supplier CCC of approximately 15 days on average, though the sample was confined to large European corporations. Silvestri et al. (2021) provided event study evidence that SCF program announcements were associated with positive cumulative abnormal returns for announcing firms, suggesting that financial markets interpret SCF adoption as value-creating. Neither study examined SME-specific outcomes, and no study to date has employed dynamic panel methods to address the persistence of working capital outcomes and the endogeneity of adoption decisions in an emerging market manufacturing context.

2.4. Moderating Factors in SCF Effectiveness

The SCF literature has increasingly recognized that program performance is heterogeneous across firms and program designs. Buyer relationship quality has been identified as a critical moderator: suppliers with longer-tenured, higher-volume buyer relationships have access to confirmed invoice programs with lower discounting rates and fewer documentation requirements, amplifying the working capital benefit of SCF participation (Kouvelis & Zhao, 2012). Anchor buyer credit rating directly determines the reverse factoring pricing advantage available to suppliers, creating a stratified distribution of SCF benefits in which suppliers of investment-grade buyers gain more than those of sub-investment-grade buyers.

Digital platform maturity has emerged as an increasingly important determinant of SCF program efficiency as fintech-enabled SCF platforms have entered competition with bank-administered programs. Platforms offering automated invoice matching, real-time confirmation, and straight-through processing eliminate the manual verification delays that historically limited SCF scalability for smaller transaction volumes. Camerinelli (2009) argued that platform digitization was the enabling condition for SCF's extension from large corporates to the SME segment, and subsequent practitioner evidence from platforms including Taulia, C2FO, and Orbian has supported this proposition, though academic validation using enterprise-level outcome data is limited.

2.5. Research Gaps

Four gaps in the existing literature directly motivate the present study. First, quantitative evidence on SCF performance outcomes specifically among manufacturing SMEs, rather than large corporations, is absent. Second, the endogeneity of SCF adoption, arising from the possibility that financially healthier SMEs are more likely to be invited into anchor buyer SCF programs, has not been addressed through appropriate instrumental variable or dynamic panel methods in any published study. Third, Southeast Asia as a regional context for SCF research has been entirely neglected despite the region's significance as a global manufacturing hub. Fourth, the mechanisms linking SCF adoption to working capital improvements, mediated by buyer relationship quality and platform digital maturity, have not been tested within a unified quantitative and qualitative framework.

III. RESEARCH METHODOLOGY

3.1. Research Design

This study employs a mixed-methods longitudinal research design. The quantitative strand uses a balanced panel of manufacturing SMEs observed across eight consecutive fiscal years, enabling the application of firm and year fixed effects to control for time-invariant heterogeneity and macroeconomic confounders. The dynamic panel generalized method of moments (GMM) estimator is employed as the primary identification strategy to address the dual challenges of working capital persistence and endogenous SCF adoption. The qualitative strand collects semi-structured interview data from SCF program managers at anchor buyers and financial institutions, and from finance directors at adopting SMEs, to illuminate the operational mechanisms, relational dynamics, and institutional barriers that quantitative data cannot directly capture. The mixed-methods integration follows a sequential explanatory design in which quantitative findings guide qualitative inquiry (Creswell and Plano Clark, 2018).

3.2. Research Objectives

The following specific objectives guided the study:

- Objective 1: To estimate the effect of SCF adoption on the cash conversion cycle of manufacturing SMEs in Thailand, Indonesia, and the Philippines using two-way fixed effects and dynamic GMM panel methods.
- Objective 2: To examine the effect of SCF adoption on return on assets, controlling for firm size, leverage, sales growth, and macroeconomic conditions.
- Objective 3: To test the moderating roles of buyer relationship quality, anchor buyer credit rating, and SCF platform digital maturity on the SCF-performance relationship.
- Objective 4: To explore qualitatively the operational mechanisms through which SCF adoption generates working capital improvements and the barriers that limit realization of program benefits.

3.3. Hypotheses

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

- H1: SCF adoption is negatively associated with the cash conversion cycle among manufacturing SMEs.
- H2: SCF adoption is positively associated with return on assets among manufacturing SMEs.
- H3: Buyer relationship quality positively moderates the effect of SCF adoption on cash conversion cycle reduction.
- H4: Anchor buyer credit rating positively moderates the effect of SCF adoption on both cash conversion cycle and return on assets.
- H5: SCF platform digital maturity positively moderates the effect of SCF adoption on cash conversion cycle reduction.
- H6: The positive effect of SCF adoption on return on assets is mediated by cash conversion cycle efficiency.

3.4. Sample and Data

The target population comprised manufacturing SMEs with annual revenues between USD 500,000 and USD 50 million, at least five employees, and at least one verifiable buyer-supplier relationship with an anchor firm operating an SCF program. Three countries were selected to represent distinct ASEAN manufacturing contexts: Thailand, a middle-income economy with a highly developed automotive and electronics manufacturing export base and an established SCF ecosystem operated by commercial banks including Bangkok Bank and Kasikorn Bank; Indonesia, Southeast Asia's largest economy with a large and diversified manufacturing SME sector and a rapidly expanding fintech SCF platform market; and the Philippines, a lower-middle-income economy with a manufacturing sector concentrated in electronics assembly and food processing, and a nascent but growing SCF regulatory framework under the Bangko Sentral ng Pilipinas.

The final balanced panel comprised 341 SMEs, distributed as 121 in Thailand, 118 in Indonesia, and 102 in the Philippines. Of these, 178 adopted an SCF program at some point during the 2016 to 2023 observation window, while 163 remained non-adopters throughout the panel. Financial statement data were sourced from national business registry databases and supplemented by direct data collection from firm financial records under data sharing agreements. SCF adoption status, program type, platform type, and buyer relationship characteristics were verified through SCF program administrators at participating anchor buyers and financial institutions. A structured survey instrument was administered annually to collect governance and relationship quality variables not available in administrative records.

3.5. Variable Measurement

The cash conversion cycle was calculated as days sales outstanding plus days inventory outstanding minus days payable outstanding, using annual financial statement data, following Deloof (2003). Return on assets was measured as earnings before interest and taxes divided by total assets. SCF adoption was operationalized as a binary time-varying indicator taking the value of 1 from the first fiscal year of confirmed program participation, and 0 otherwise.

Buyer relationship quality was measured as a composite score averaging three dimensions: buyer relationship tenure in years (log-transformed), share of the SME's total sales accounted for by the primary anchor buyer (proxy for relationship intensity), and a survey-based rating of buyer payment reliability and communication quality, rated on a five-point scale. Anchor buyer credit rating was captured as the long-term local currency rating of the primary anchor buyer, converted to a numerical scale from 1 (below investment grade) to 7 (AAA equivalent) using a standardized crosswalk across rating agency scales. SCF platform digital maturity was assessed using a four-item scale capturing straight-through processing capability, mobile access, real-time invoice status visibility, and integration with the SME's enterprise resource planning system.

Control variables included firm age (years since registration), firm size (log of total assets), leverage (total debt to total assets), sales growth (year-on-year revenue change), industry sub-sector (coded as electronics, automotive, food processing, textiles, and other), and country-year GDP growth rate. All financial variables were winsorized at the 1st and 99th percentiles.

3.6. Analytical Strategy

The primary quantitative analysis proceeded in three stages. First, two-way firm and year fixed effects OLS regression was estimated for each outcome variable, with standard errors clustered at the firm level. While this specification controls for time-invariant confounders, it does not address the persistence of the CCC or the endogeneity of SCF adoption arising from potential selection on unobservable time-varying firm characteristics. Second, the system GMM estimator of Blundell and Bond (1998), as implemented in Stata's xtdpdsys command, was applied to both outcome equations. The GMM specification treats SCF adoption and lagged outcome variables as endogenous, using second and deeper lags as internal instruments, and employs external instruments comprising lagged anchor buyer SCF program expansion decisions and national SCF regulatory development indices, which affect individual SME adoption probability but are plausibly excludable from the firm-level performance equation. Instrument validity was assessed using the Hansen J test and the Arellano-Bond AR(2) test for second-order serial correlation.

Third, moderation analysis was conducted by including interaction terms between SCF adoption and the three moderating variables in the system GMM specification. Mediation analysis testing H6 followed the product-of-coefficients approach with bootstrapped confidence intervals using 5,000 replications (Preacher & Hayes, 2008). Semi-structured interview data were analyzed using directed content analysis with a deductive framework derived from the theoretical model, augmented by inductively generated codes capturing operationally specific mechanisms not anticipated by the framework.

IV. RESULTS

4.1. Descriptive Statistics and Pre-Adoption Trends

The full sample had a mean CCC of 64.7 days (SD = 28.3) in the base year of 2016, broadly consistent with regional benchmarks for manufacturing SMEs documented by the Asian Development Bank (2018). Mean return on assets was 6.8%

(SD = 4.2%). SCF adopters exhibited pre-adoption CCCs that were slightly longer than non-adopters (67.3 versus 61.8 days, t-test p = 0.067), suggesting a mild tendency for firms with greater working capital pressure to self-select into SCF programs. This pattern underscores the importance of addressing endogeneity in the main analysis. Pre-adoption return on assets did not differ significantly between adopters and non-adopters (6.5% versus 7.1%, p = 0.183), providing some assurance that adoption was not driven by pre-existing profitability differences.

4.2. Effect of SCF Adoption on Cash Conversion Cycle

The two-way fixed effects estimate of the SCF adoption effect on the CCC was negative and significant (beta = -14.7 days, SE = 2.8, t = -5.25, p < 0.001), providing preliminary support for H1. The system GMM estimate, which accounts for CCC persistence and adoption endogeneity, yielded a somewhat larger coefficient (beta = -18.4 days, SE = 3.4, t = -5.41, p < 0.001), suggesting that the fixed effects estimate understated the true adoption effect, likely due to attenuation from unobserved time-varying selection. The Hansen J statistic was non-significant (p = 0.347) and the AR(2) test confirmed absence of second-order serial correlation (p = 0.214), supporting instrument validity. Country-disaggregated GMM estimates revealed CCC reductions of 20.1 days in Thailand, 18.6 days in Indonesia, and 16.2 days in the Philippines, with the somewhat smaller Philippine effect reflecting the lower digital maturity of SCF platforms operating in that market during the early years of the panel.

Decomposition of the CCC effect showed that the reduction operated primarily through the accounts receivable channel: days sales outstanding declined by an average of 12.3 days post-adoption (p < 0.001), reflecting the accelerated collection facilitated by reverse factoring. Days payable outstanding increased slightly (mean = 3.1 days, p < 0.05), consistent with buyer incentives to maintain or extend payment terms within SCF program structures. Days inventory outstanding showed no significant change (p = 0.412), confirming that the SCF benefit was confined to the financial rather than the operational dimension of the working capital cycle.

4.3. Effect of SCF Adoption on Return on Assets

The system GMM estimate for return on assets confirmed a significant positive effect of SCF adoption (beta = 2.31 percentage points, SE = 0.84, t = 2.75, p < 0.01), supporting H2. The magnitude of this effect is economically meaningful given the sample mean ROA of 6.8%, representing a 34% proportional improvement attributable to SCF participation. Instrument validity statistics were again satisfactory (Hansen J p = 0.291, AR(2) p = 0.183). The ROA improvement was somewhat larger in the electronics subsector (beta = 2.89 percentage points) than in food processing (beta = 1.94 percentage points) and textiles (beta = 1.73 percentage points), consistent with the higher receivables intensity of electronics supply chains and the correspondingly greater financial benefit of accelerated collection through reverse factoring.

4.4. Moderation Analysis

All three moderation hypotheses received empirical support. The interaction between SCF adoption and buyer relationship quality was negative and significant in the CCC equation (beta = -4.6 days, SE = 1.9, t = -2.42, p < 0.05), supporting H3: SMEs with higher-quality buyer relationships achieved larger CCC reductions from SCF adoption, likely reflecting the preferential program terms, lower invoice discrepancy rates, and more rapid payment confirmation available in long-established, high-volume buyer relationships.

The anchor buyer credit rating interaction was significant for both CCC (beta = -3.2 days per rating grade, SE = 1.4, t = -2.29, p < 0.05) and ROA (beta = 0.41 percentage points per rating grade, SE = 0.18, t = 2.28, p < 0.05), supporting H4. The gradient effect of credit rating on program outcomes confirms that the pricing advantage of SCF, which is the fundamental economic mechanism, is directly proportional to the anchor buyer's creditworthiness. SCF platform digital maturity moderated the CCC reduction significantly (beta = -2.8 days per maturity unit, SE = 1.3, t = -2.15, p < 0.05), supporting H5, with firms on higher-maturity digital platforms achieving faster invoice processing, lower discrepancy rates, and more reliable financing availability.

4.5. Mediation Analysis

The bootstrapped mediation analysis confirmed that the CCC partially mediated the relationship between SCF adoption and ROA improvement (indirect effect = 0.74 percentage points, 95% CI: 0.31 to 1.21). The direct effect of SCF adoption on ROA remained significant after controlling for CCC (direct effect = 1.57 percentage points, p < 0.05), indicating partial rather than full mediation and suggesting that SCF generates ROA improvements through both working capital efficiency channels and additional pathways including reduced financing costs, improved supplier credit terms, and enhanced buyer relationship stability, supporting H6.

4.6. Interview Findings

Directed content analysis of the 28 semi-structured interviews generated four thematic domains: accelerated liquidity and reinvestment cycles, relationship capital deepening, platform experience and trust formation, and institutional barriers to program scaling.

4.6.1. Theme 1: Accelerated Liquidity and Reinvestment Cycles

SCF program participants consistently described the practical mechanism of CCC improvement in operational terms: the availability of early payment against confirmed invoices allowed them to reinitiate production cycles, replenish raw material inventory, and accept new orders more rapidly than their pre-SCF cash flow rhythms permitted. Several electronics subcontractor managers in Thailand described SCF as effectively converting a 60-day receivables cycle into a 5-day cycle, enabling a doubling of production throughput within the same capital base. This operational reinvestment effect, documented

quantitatively through the ROA improvement, emerged as the primary mechanism of profitability impact in the qualitative data.

4.6.2. Theme 2: Relationship Capital Deepening

An unexpected but recurrent qualitative finding was that SCF program participation deepened buyer-supplier relationships through channels beyond direct financial benefit. Participants described the SCF enrollment process as having prompted more structured financial information sharing with anchor buyers, which in turn led to more transparent order forecasting, production planning collaboration, and quality improvement feedback. Several Thai automotive component suppliers noted that participation in their anchor buyer's SCF program had been a prerequisite for inclusion in new model sourcing shortlists, creating a strategic dimension to SCF adoption that extended well beyond its immediate working capital function.

4.6.3. Theme 3: Platform Experience and Trust Formation

Platform digital maturity was a prominent experiential theme, with marked differences between participants using bank-administered paper-based programs and those on fully digital fintech platforms. Participants on higher-maturity platforms described substantially lower administrative burden, real-time payment status visibility that improved treasury planning confidence, and the ability to make daily early payment decisions based on current cash position rather than predetermined discount schedules. Trust in the platform emerged as a dynamic rather than static variable, with initial skepticism about data security and discrepancy resolution procedures giving way to operational confidence after several successful program cycles, a pattern consistent with Lumineau et al. (2021) in the blockchain context.

4.6.4. Theme 4: Institutional Barriers to Program Scaling

Despite widespread satisfaction with SCF benefits among adopters, several institutional barriers limiting program reach and depth were identified. First, smaller SMEs below the minimum invoice size thresholds set by bank SCF programs reported exclusion from the most competitively priced programs, creating a two-tier SCF market in which the smallest and most financially vulnerable suppliers were confined to higher-cost alternatives. Second, cross-border SCF involving suppliers and buyers in different ASEAN countries faced significant regulatory fragmentation, with differing invoice discounting regulations, foreign exchange controls, and digital signature standards across member states creating compliance complexity that deterred multi-country program expansion. Third, in Indonesia and the Philippines, a subset of SME managers expressed residual skepticism about voluntarily sharing detailed invoice and financial data with bank-administered SCF platforms, citing privacy concerns and fear of adverse credit monitoring.

V. DISCUSSION

The findings of this study make five substantive contributions to the supply chain finance, working capital management, and SME finance literatures. First, the dynamic GMM estimate of an 18.4-day CCC reduction attributable to SCF adoption is the most methodologically rigorous enterprise-level estimate of SCF's working capital effects in any published study, and the first such estimate for manufacturing SMEs in Southeast Asia. The larger GMM estimate relative to the fixed effects estimate confirms that OLS-based studies in this literature understate the causal effect of SCF adoption due to negative selection: firms with longer CCCs are more likely to adopt, biasing cross-sectional estimates toward zero. Future quantitative SCF research should routinely apply dynamic panel methods to address this identification challenge.

Second, the mediation finding that CCC improvement only partially mediates the SCF-ROA relationship suggests that working capital efficiency, while the primary theoretical channel, is not the sole mechanism through which SCF adoption generates profitability gains. The residual direct effect may reflect financing cost savings, product mix optimization enabled by more flexible production cycling, and relationship-deepening benefits documented in the qualitative findings. This multidimensional value creation architecture implies that studies limiting their scope to CCC outcomes understate the full financial impact of SCF adoption for SME participants.

Third, the moderation findings collectively map the conditions under which SCF adoption generates the largest performance returns. The convergence of high buyer relationship quality, investment-grade anchor buyer credit rating, and high platform digital maturity defines an ideal SCF adoption context that delivers the largest CCC reductions and profitability improvements. In practice, SMEs will rarely enjoy all three conditions simultaneously, and the heterogeneity of SCF outcomes documented across the sample reflects the varying combinations of these enabling conditions across the panel. SCF program designers and financial intermediaries should incorporate these moderating factors into SME eligibility and pricing frameworks.

Fourth, the ASEAN cross-country evidence reveals meaningful contextual heterogeneity that has important implications for regional SCF policy harmonization. Thailand's more advanced SCF ecosystem, established commercial bank programs, and higher digital platform maturity generates the largest per-program adoption benefits. The Philippines' smaller platform digital maturity attenuates benefits, pointing to the platform infrastructure investment gap as the most actionable policy lever in that context. Indonesia's large and diverse manufacturing SME sector, combined with a rapidly expanding fintech SCF market, positions it for proportionally the largest SCF expansion dividend if regulatory clarity and platform interoperability can be improved.

Fifth, the qualitative evidence on institutional barriers enriches the quantitative findings by identifying the minimum invoice size exclusion problem as a structural equity concern: the smallest and most financially fragile SMEs are systematically excluded from the most competitively priced SCF programs, limiting the financial inclusion potential of SCF as a policy instrument. This finding argues for the design of tiered SCF programs with lower invoice minimums, potentially supported by

credit risk-sharing arrangements between SCF platforms and development finance institutions, to extend the benefits of SCF to the full spectrum of manufacturing SME participants.

VI. CONCLUSION

This study provides the most methodologically rigorous and contextually grounded evidence to date that supply chain finance adoption generates significant and causally identified improvements in cash conversion cycle efficiency and profitability among manufacturing SMEs in Southeast Asia. The 18.4-day CCC reduction and 2.3 percentage point ROA improvement, estimated using dynamic GMM methods that address the dual challenges of working capital persistence and endogenous adoption, represent substantial and practically meaningful performance gains for an SME segment chronically underserved by conventional financial intermediation.

For ASEAN policymakers and the ASEAN Coordinating Committee on Micro, Small and Medium Enterprises, the findings argue for the prioritization of three mutually reinforcing policy tracks. First, regulatory harmonization of invoice discounting, digital signature, and cross-border payment standards across ASEAN member states would dramatically expand the addressable market for multi-country SCF programs and reduce the compliance costs that currently deter regional program expansion. Second, targeted digital infrastructure investment, including broadband access, e-invoicing system standardization, and fintech SCF licensing frameworks, would accelerate the platform digital maturity improvements that the moderation analysis identifies as a key amplifier of SCF performance benefits. Third, blended finance arrangements combining development bank credit risk guarantees with commercial SCF platform operations could extend program access to smaller SMEs currently excluded by minimum invoice size thresholds.

For commercial banks and fintech SCF platform operators, the study's evidence on buyer relationship quality and platform digital maturity as performance moderators offers concrete product design guidance. Platforms should invest in automated invoice matching, real-time confirmation workflows, and seamless ERP integration to maximize working capital acceleration for SME clients. Relationship managers at anchor buyer firms should be equipped to communicate the full strategic value of SCF enrollment to supplier SMEs, including the order preference and forecasting collaboration benefits documented in the qualitative findings.

Several limitations of this study warrant acknowledgment. The balanced panel design, while enhancing statistical efficiency, required the exclusion of firms with incomplete eight-year data series, potentially introducing survivorship bias toward more stable SMEs. The SCF adoption measure, while verified through program administrator records, does not capture variation in program utilization intensity, and future research should examine whether utilization depth mediates the relationship between adoption and performance outcomes. The study is confined to three ASEAN countries, and extension to Vietnam, Myanmar, and Cambodia, where manufacturing SME sectors are expanding rapidly, would increase the generalizability of findings. Future research should also investigate the long-run dynamics of SCF adoption on firm investment, employment, and export intensity, and examine how fintech platform competition affects the pricing and accessibility of SCF instruments for the SME segment.

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Tax Compliance Behavior Among Gig Economy Workers in Developing Countries: The Interplay of Tax Morale, Institutional Trust, and Digital Tax Administration

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Abstract

The rapid expansion of digital platform-mediated gig work has created a structurally novel compliance challenge for tax administrations in developing countries, as millions of self-employed individuals earning income through ride-hailing, freelance, delivery, and domestic services platforms generate taxable income that falls largely outside the third-party withholding frameworks that anchor compliance in formal employment. This study investigates the determinants of voluntary tax compliance behavior among gig economy workers in Mexico, Morocco, and Bangladesh, integrating the Slippery Slope Framework of Kirchler with tax morale theory and behavioral public finance to develop a model in which institutional trust, perceived power of authority, tax morale, and digital tax administration quality jointly determine compliance behavior. Using a vignette-based survey experiment administered to 541 active gig workers, supplemented by 32 in-depth interviews, the study employs ordered logistic regression and structural equation modeling to estimate the relative effects of voluntary and enforced compliance pathways. Results indicate that tax morale exerts the strongest effect on compliance intention (beta = 0.52, $p < 0.001$), followed by trust in tax authority (beta = 0.38, $p < 0.001$), digital tax administration quality (beta = 0.34, $p < 0.001$), and perceived audit probability (beta = 0.27, $p < 0.01$). Income transparency, generated by digital platform payment records, moderates the compliance-intention-behavior gap. Country-level institutional environment significantly moderates all structural relationships. The study contributes to the behavioral tax compliance literature and offers targeted recommendations for revenue authorities seeking to extend the fiscal reach of digital taxation to the growing gig workforce.

Keywords: - Tax Compliance, Gig Economy, Tax Morale, Slippery Slope Framework, Institutional Trust, Digital Tax Administration, Developing Countries, Vignette Experiment

I. INTRODUCTION

The global gig economy, broadly defined as the ecosystem of platform-mediated, short-tenure, task-based work arrangements, has expanded at a remarkable pace since the emergence of major ride-hailing, freelance, and on-demand service platforms in the early 2010s. Estimates suggest that gig workers account for between 15 and 25 percent of the labor force in middle-income economies and that platform-mediated gig work is growing at annual rates of 15 to 25 percent across major emerging markets (World Bank, 2019). This structural shift in labor market organization has profound implications for public finance: the gig economy generates substantial taxable income that largely escapes the third-party information reporting and withholding mechanisms that constitute the backbone of income tax administration in most jurisdictions (OECD, 2020).

Conventional income tax systems in developing countries rely heavily on employer withholding of wages and, to a lesser extent, corporate profit reporting, to generate fiscal revenue and constrain non-compliance. Self-employed individuals, who bear sole responsibility for their own tax declaration and payment, consistently exhibit lower compliance rates than wage employees, a pattern attributed to the combination of lower detection probability, greater income variability, and weaker

normative compliance infrastructure (Kleven et al., 2011). Gig workers occupy a hybrid position in this landscape: many are registered as self-employed or independent contractors and therefore legally subject to self-assessment regimes, yet their income flows through digital platform intermediaries that possess comprehensive transactional data. This data availability creates an unprecedented technical opportunity for revenue authorities to extend third-party reporting to gig income streams, but its realization requires both regulatory innovation and gig worker behavioral cooperation.

The behavioral dimensions of gig worker tax compliance have received limited academic attention. The established tax compliance literature, rooted in the expected utility model of Allingham and Sandmo (1972) and subsequently extended by the Slippery Slope Framework (SSF) of Kirchler et al. (2008) and by tax morale theory (Torgler, 2007), has been developed primarily in advanced economy contexts and applied primarily to wage employees and formal sector self-employed individuals. Its applicability to gig workers in developing countries, who operate in institutionally and technologically distinct environments, remains an open empirical question.

Developing country contexts introduce several compounding factors. Institutional trust in government and tax authorities is generally lower than in advanced economies, reflecting historical experiences of corruption, perceived inequity in public spending, and limited visible fiscal exchange (Fjeldstad & Semboja, 2001). Tax morale, the intrinsic motivation to pay taxes as a civic duty, is shaped by cultural norms, social capital, and the perceived fairness of the tax system, all of which vary substantially across developing country contexts (Torgler & Schneider, 2007). Digital tax administration reforms, including e-filing systems, electronic payment platforms, and real-time audit analytics, are being actively implemented across developing countries and may reduce the compliance costs that deter voluntary declaration among gig workers, but their behavioral effects have not been rigorously evaluated.

This study addresses these gaps through three research questions:

- What is the relative importance of tax morale, institutional trust, perceived enforcement power, and digital administration quality as determinants of voluntary tax compliance among gig workers in Mexico, Morocco, and Bangladesh?
- Does income transparency generated by digital platform payment records moderate the gap between compliance intentions and actual compliance behavior?
- How does the institutional and regulatory environment moderate the relationships between these determinants and compliance outcomes?

The remainder of this paper is organized as follows. Section 2 develops the theoretical framework and reviews the empirical literature. Section 3 describes the research design, sample, and analytical methods. Section 4 presents the empirical results. Section 5 discusses the findings and their implications. Section 6 concludes with policy recommendations and directions for future research.

II. LITERATURE REVIEW

2.1. Theoretical Foundations of Tax Compliance

The theoretical literature on tax compliance has evolved through three intellectual generations. The first generation, originating with Allingham and Sandmo (1972), modeled tax compliance as a rational expected utility calculation in which the taxpayer weighs the financial gain from evasion against the expected penalty, determined by the product of the audit probability and the sanction rate. This deterrence-based framework generated important insights into the sensitivity of compliance to audit rates and penalty structures, but was subsequently criticized for its failure to explain the empirically high compliance levels observed even in low-audit probability environments and for its neglect of the social and moral dimensions of compliance behavior (Alm, 2019).

The second generation incorporated psychological and sociological dimensions through tax morale theory (Schmolders, 1960; Torgler, 2007). Tax morale, defined as the intrinsic motivation to contribute to the public good through tax payment, encompasses civic duty, social norms, perceived fairness, and trust in government as determinants of compliance that operate independently of enforcement threats. Frey and Feld (2002) advanced the fiscal exchange hypothesis, arguing that tax morale is enhanced when taxpayers perceive a fair exchange between their contributions and the public services they receive, and is crowded out when authorities signal distrust of taxpayers through heavy enforcement.

The third generation, represented most comprehensively by Kirchler et al.'s (2008) Slippery Slope Framework, integrates deterrence and motivation-based perspectives within a unified model. The SSF posits that compliance is determined by the joint operation of two dimensions: the power of the authority, encompassing its capacity to detect and penalize non-compliance, and the trust of citizens in the authority, reflecting confidence in its competence, benevolence, and procedural fairness. High power generates enforced compliance through deterrence, while high trust generates voluntary compliance through intrinsic motivation. The framework predicts that combinations of high power and high trust generate the highest total compliance, and that eroding trust through exclusively coercive enforcement strategies may undermine voluntary compliance even as enforced compliance rises.

2.2. Gig Economy Taxation: Structural Challenges and Emerging Responses

The gig economy presents a structurally novel tax administration challenge for three interconnected reasons. First, income fragmentation across multiple platforms and task types makes comprehensive income tracking difficult for tax administrations that rely on employer-reported W-2 or equivalent annual income summaries (OECD, 2020). Second, the legal classification ambiguity of gig workers, who are typically classified as independent contractors rather than employees by platform operators, exempts platforms from employer withholding obligations in most jurisdictions while leaving individual gig workers formally responsible for self-assessment. Third, the income volatility and informality of gig work, combined with

low financial literacy among many gig workers, generates genuine uncertainty about tax obligations rather than deliberate evasion in many cases.

Several jurisdictions have experimented with regulatory innovations to improve gig income compliance. The United States lowered the 1099-K reporting threshold for payment platforms from USD 20,000 to USD 600 in 2021, substantially expanding platform-level income reporting to tax authorities (IRS, 2022). The European Union's DAC7 directive, effective from 2023, mandates that digital platforms report seller and service provider income to tax authorities in member states, creating a comprehensive third-party information framework for gig income streams (European Commission, 2021). Developing country revenue authorities have been slower to implement equivalent measures, though Indonesia's Directorate General of Taxes introduced platform operator income reporting obligations in 2020 and Morocco's Direction Generale des Impots launched a digital self-declaration portal for independent workers in 2021.

2.3. Tax Morale in Developing Country Contexts

Cross-national evidence on tax morale levels and determinants has been substantially advanced by the World Values Survey and the International Social Survey Programme, both of which include standardized tax attitude items. Torgler and Schneider (2007) analyzed data from over 30 countries and found that tax morale was significantly positively associated with institutional trust, religiosity, satisfaction with democracy, and perceived government efficiency, while being negatively associated with corruption perceptions and income inequality. The effect of institutional trust was particularly pronounced in developing countries, where the credibility of the fiscal exchange relationship is more contested.

Developing country-specific studies have confirmed these broad patterns while documenting important contextual heterogeneity. Fjeldstad and Semboja (2001) found in Tanzania that tax morale was strongly conditioned by the perceived use of tax revenues, with compliance intentions declining sharply when respondents believed taxes were diverted through corruption. Alm and Gomez (2008) documented in Colombia that compliance was higher among taxpayers who interacted regularly with public services, confirming the fiscal exchange hypothesis in a Latin American context. Benali and Lahlou (2019) found in Morocco that trust in the tax administration, distinct from broader government trust, was the strongest predictor of small business owner compliance intention, suggesting that administrative-level rather than only government-level trust is behaviorally relevant.

2.4. Digital Tax Administration and Compliance Behavior

The digitalization of tax administration has emerged as a major policy priority for revenue authorities globally, driven by expectations of reduced compliance costs, improved taxpayer service quality, and enhanced audit analytics capability (OECD, 2020). Electronic filing systems, pre-populated tax returns, digital payment integration, and real-time taxpayer service portals represent a suite of digital innovations that theory predicts should increase voluntary compliance by reducing procedural friction and signaling administrative competence. Empirical evidence on the behavioral effects of digital administration reforms is growing. Kleven et al. (2011) demonstrated in a Danish context that third-party information reporting dramatically increased income reporting accuracy for wage income, while self-reported income showed much higher evasion rates, confirming the central role of information transparency rather than merely filing modality.

In developing country contexts, Okunogbe and Pouliquen (2022) conducted a randomized field experiment in Uganda and found that electronic filing adoption by small business taxpayers was associated with a 12 percentage point increase in self-reported income, attributable primarily to reduced compliance cost friction rather than increased detection risk. Mascagni et al. (2021) reviewed evidence from twelve African countries and concluded that digital administration reforms generated the most consistent compliance improvements when accompanied by taxpayer education programs and perceived service quality improvements, and the least consistent improvements when implemented in low-trust institutional environments without complementary trust-building measures.

2.5. Vignette-Based Survey Experiments in Tax Compliance Research

Survey experiments, including vignette-based designs, have been increasingly employed in tax compliance research to overcome the social desirability bias and hypothetical-actual gap that afflicts direct compliance attitude questions. Vignette experiments present respondents with realistic fictional scenarios describing taxpayers facing compliance decisions and ask respondents to evaluate the fictional taxpayer's behavior or indicate what they would do in the described situation. This design reduces self-incrimination concerns, enables systematic manipulation of scenario parameters such as audit probability and penalty severity, and allows causal identification of the effects of specific contextual factors on compliance judgments (Hainmueller et al., 2015). Blaufus et al. (2017) validated vignette-based tax compliance measures against administrative data and found acceptable convergent validity, supporting their use in contexts where administrative data are unavailable.

2.6. Research Gaps

The review identifies five research gaps motivating this study. First, the specific compliance behavior of gig economy workers in developing countries has not been examined empirically. Second, the SSF has rarely been applied in a multi-country emerging market context with simultaneous testing of all four quadrant predictions. Third, the moderating effect of digital platform-generated income transparency on the intention-behavior gap in tax compliance has not been tested. Fourth, the behavioral effects of digital tax administration quality among self-employed informal-sector-adjacent workers in developing countries have not been empirically examined. Fifth, a vignette-based experimental design, offering greater causal clarity than observational surveys, has not been applied to gig worker compliance research in any developing country context.

III. RESEARCH METHODOLOGY

3.1. Research Design

A sequential mixed-methods design was employed, comprising a vignette-based survey experiment as the primary quantitative component and in-depth interviews as the qualitative component. The vignette experiment was designed to elicit compliance intentions and judgments under controlled variation in audit probability, penalty rate, institutional trust cues, and digital administration quality cues, enabling causal identification of SSF pathway effects while minimizing social desirability response bias. The qualitative component captured the reasoning, experiential context, and institutional perceptions that shape compliance decisions in ways not fully captured by closed-form vignette responses.

3.2. Research Objectives

The study was organized around the following specific objectives:

- Objective 1: To measure the levels of tax morale, institutional trust, perceived enforcement power, and digital tax administration quality among gig workers in Mexico, Morocco, and Bangladesh.
- Objective 2: To estimate the relative effects of the voluntary compliance pathway (tax morale, institutional trust) and the enforced compliance pathway (perceived audit probability, penalty severity) on compliance intention and behavior.
- Objective 3: To test whether income transparency from digital platform payment records moderates the compliance intention-behavior gap.
- Objective 4: To examine the cross-national moderating effects of institutional environment on the SSF compliance pathways.
- Objective 5: To explore qualitatively the mechanisms through which trust, enforcement, and digital administration perceptions shape gig workers' compliance reasoning.

3.3. Hypotheses

The following hypotheses were specified for empirical testing

- H1: Tax morale is positively associated with voluntary tax compliance intention among gig workers.
- H2: Institutional trust in tax authority is positively associated with voluntary tax compliance intention.
- H3: Perceived audit probability is positively associated with enforced tax compliance intention.
- H4: Digital tax administration quality is positively associated with voluntary tax compliance intention.
- H5: Income transparency from digital platform records positively moderates the relationship between compliance intention and actual compliance behavior.
- H6: Tax morale mediates the relationship between institutional trust and voluntary compliance intention.
- H7: Country-level institutional environment significantly moderates the strength of the voluntary compliance pathway relative to the enforced compliance pathway.

3.4. Country Selection and Sample

Mexico, Morocco, and Bangladesh were selected as study sites to represent three distinct institutional and gig economy development contexts. Mexico is an upper-middle-income Latin American economy with a large and rapidly growing gig sector, primarily in ride-hailing (Uber, Cabify, DiDi) and food delivery (Rappi, iFood), a history of low institutional trust in tax administration, and a recently launched digital self-declaration system for independent workers under the Regimen Simplificado de Confianza introduced in 2022. Morocco is a lower-middle-income North African economy with a growing freelance and digital services gig sector, an active Direction Generale des Impots digitalization program, and civil law institutional heritage. Bangladesh is a lower-middle-income South Asian economy with a large ride-hailing and logistics gig sector (Pathao, Shohoz, Uber), among the lowest formal sector tax-to-GDP ratios in Asia, and a nascent but expanding National Board of Revenue digital administration initiative.

Purposive stratified sampling targeted active gig workers registered on at least one platform and having earned income from gig activities in the three months preceding the survey. Recruitment was conducted through platform operator referral networks, gig worker associations, and social media community groups specific to each country. A total of 541 complete and valid survey responses were obtained: 189 from Mexico, 178 from Morocco, and 174 from Bangladesh. For the qualitative component, 32 in-depth interviews were conducted with purposively selected participants representing diverse platform types, income levels, and compliance history profiles. Interviews were conducted in Spanish, French, Darija, and Bengali, professionally transcribed, and translated into English.

3.5. Vignette Design and Measures

The vignette instrument presented each respondent with three scenarios depicting a fictional gig worker, matched to the respondent's own platform type, facing an income declaration decision at the end of a fiscal year. Scenarios were constructed using a fractional factorial design varying five within-vignette factors: audit probability (low: 2%, moderate: 15%, high: 40%), penalty rate (1x, 2x, or 3x undeclared income), institutional trust cue (neutral, positive, or negative framing of tax authority behavior), digital administration quality cue (absent, basic e-filing portal, or advanced pre-populated return), and platform income transparency cue (income verifiable from platform records, income partially verifiable, income unverifiable). Each respondent evaluated three randomly assigned vignette profiles, generating 1,623 vignette-level observations across the full sample.

For each vignette, respondents rated the likelihood that the fictional worker would fully declare income on a seven-point scale from 1 (extremely unlikely) to 7 (extremely likely) and indicated what they personally would do in the same situation on a five-point behavioral intention scale. Actual compliance behavior was measured through a separate behavioral question asking respondents to report their own most recent tax filing decision, coded on a three-point scale: fully declared,

partially declared, and not declared. Tax morale was assessed using an eight-item scale adapted from Torgler (2007), capturing civic duty orientation, perceived fairness, and social norm compliance. Institutional trust was measured using six items adapted from Kirchler et al. (2008) specifically targeting tax authority trust. Digital tax administration quality was measured using a five-item scale assessing e-filing ease, portal reliability, pre-population accuracy, response time to queries, and payment convenience. Perceived audit probability was elicited through a direct probability estimate question calibrated to the respondent's income range and platform type.

A pilot study of 60 respondents across the three countries confirmed satisfactory internal consistency across all scales (Cronbach's alpha ranging from 0.73 to 0.88) and adequate comprehension of vignette scenarios through cognitive debriefing interviews.

3.6. Analytical Strategy

Three analytical methods were employed. First, multilevel ordered logistic regression with vignette-level random effects was used to estimate the within-subject effects of experimentally manipulated vignette factors on fictional compliance judgments, controlling for respondent-level covariates. This specification exploits the within-subject repeated measures structure of the vignette design to isolate the causal effects of each factor manipulation.

Second, structural equation modeling in the PLS-SEM framework, implemented in SmartPLS 4, was used to estimate the structural relationships between tax morale, institutional trust, perceived audit probability, digital administration quality, and self-reported compliance intention and behavior using the between-subject observational data. The SSF's voluntary and enforced compliance pathways were modeled as parallel mediation chains, and bootstrap confidence intervals were generated for all indirect effects. Measurement model adequacy was assessed using standard reflective validity criteria following Hair et al. (2022).

Third, moderation hypotheses were tested through interaction terms in both the multilevel regression (for vignette-level moderators) and the PLS-SEM specification (for respondent-level moderators including country and income transparency). Country-level moderation was examined through permutation-based multi-group analysis in PLS-SEM. Qualitative interview data were analyzed using thematic analysis following Braun and Clarke (2006), with theoretical codes derived from the SSF and tax morale frameworks supplemented by inductively generated codes. Analysis was conducted in NVivo 14.

IV. RESULTS

4.1. Sample Characteristics and Descriptive Statistics

Of the 541 respondents, 67.3% were male and 32.7% female, reflecting the gender composition of formal gig platform registration in the three countries. Mean age was 31.4 years (SD = 7.8). Educational attainment was moderate: 24.2% had secondary education or below, 53.6% had some tertiary education, and 22.2% held a postgraduate qualification. Mean monthly gig income was USD 342 (PPP-adjusted), representing a primary income source for 61.4% of respondents. Ride-hailing and delivery represented the largest platform categories (43.8%), followed by digital freelancing (28.3%) and domestic and personal services (27.9%). Self-reported full tax declaration in the most recent filing period was reported by only 34.7% of respondents, with partial declaration reported by 28.4% and non-declaration by 36.9%, confirming the substantive compliance deficit motivating this research.

Mean tax morale score was 3.84 on a seven-point scale (SD = 1.21), indicating moderate intrinsic compliance motivation. Mean institutional trust was 2.97 (SD = 1.34), reflecting a generally low-trust environment consistent with prior developing country evidence. Digital tax administration quality was rated at 3.21 (SD = 1.18). Country comparisons revealed significant differences: Mexican respondents reported the highest digital administration quality (mean = 3.58) and the highest institutional trust (mean = 3.24), consistent with the more advanced stage of Mexico's Regimen Simplificado de Confianza implementation. Bangladeshi respondents reported the lowest institutional trust (mean = 2.61) and the lowest tax morale (mean = 3.47).

4.2. Multilevel Ordered Logistic Regression: Vignette Experiment Results

The multilevel ordered logistic regression on vignette-level compliance judgments confirmed significant effects for all five experimentally manipulated factors. Audit probability manipulation generated the largest single-factor effect (OR = 2.84 for high versus low audit probability, $p < 0.001$), consistent with the deterrence hypothesis. However, the positive trust cue generated an effect of comparable magnitude (OR = 2.41 versus neutral framing, $p < 0.001$), while the negative trust cue significantly reduced compliance judgments (OR = 0.63, $p < 0.001$), confirming the SSF prediction that institutional trust generates voluntary compliance that can be eroded by adversarial administrative signals. The advanced digital administration cue generated a significant positive compliance judgment effect (OR = 1.87 versus absent digital administration, $p < 0.001$), while the basic e-filing cue showed a smaller but still significant effect (OR = 1.43, $p < 0.01$), supporting H4. The platform income verifiability cue was significant (OR = 2.12 for fully verifiable versus unverifiable income, $p < 0.001$), confirming the deterrence-relevant effect of income transparency.

4.3. Structural Model: Observational Compliance Pathway Analysis

The PLS-SEM measurement model demonstrated satisfactory reliability and validity: all composite reliability values exceeded 0.80, AVE values exceeded 0.50, and HTMT ratios were below 0.85 for all construct pairs. The structural model explained 49.3% of the variance in compliance intention and 37.8% of the variance in self-reported compliance behavior.

Tax morale exerted the strongest direct effect on compliance intention (beta = 0.52, t = 9.41, $p < 0.001$, f-squared = 0.38), supporting H1 and confirming the primacy of intrinsic motivation over enforced deterrence in the voluntary pathway. Institutional trust had a significant positive direct effect (beta = 0.38, t = 6.87, $p < 0.001$), supporting H2. Digital tax administration quality showed a significant positive effect (beta = 0.34, t = 5.92, $p < 0.001$), supporting H4. Perceived audit

probability demonstrated a significant positive effect (beta = 0.27, t = 4.53, p < 0.01), supporting H3, though with a notably smaller effect size than the voluntary pathway predictors, suggesting that enforced compliance motives play a secondary role in this gig worker sample.

The mediation analysis confirmed that tax morale significantly mediated the institutional trust-compliance intention relationship (indirect effect = 0.21, 95% CI: 0.14 to 0.29), supporting H6. The proportion of the total institutional trust effect operating through the tax morale mediation pathway was 35.6%, indicating partial mediation with a substantial direct component. Income transparency significantly moderated the compliance intention-behavior relationship (interaction beta = 0.31, t = 4.12, p < 0.001), supporting H5: respondents with higher perceived income verifiability from platform records showed a stronger translation of compliance intention into actual compliance behavior, consistent with the deterrence-relevant signaling effect of income transparency on the intention-action gap.

4.4. Cross-National Multi-Group Analysis

Permutation-based PLS-MGA confirmed configural and compositional invariance across the three national samples. Structural MGA revealed that the voluntary compliance pathway (tax morale and institutional trust combined) was relatively stronger in Mexico (combined direct effects = 0.94) than in Morocco (0.87) or Bangladesh (0.79), while the enforced pathway coefficient was proportionally larger in Bangladesh (0.34) compared to Mexico (0.21) and Morocco (0.26). The digital administration quality effect was largest in Mexico (beta = 0.41), consistent with the more advanced and operationally familiar digital administration infrastructure in that country, and smallest in Bangladesh (beta = 0.26), where the digital administration quality ratings were lowest and the perception of digital reform benefits most tentative.

Country-level moderation of the SSF pathways supports H7 and provides important empirical grounding for the SSF's prediction that the relative effectiveness of voluntary versus enforced compliance strategies is institutionally contingent. In higher-trust institutional environments, voluntary pathway investments in trust-building and service quality yield proportionally larger compliance returns. In lower-trust environments, the enforcement pathway retains greater behavioral relevance, though tax morale remains a significant predictor even in Bangladesh, suggesting that intrinsic compliance motivation exists across all three contexts and is actionable through appropriate administrative strategies.

4.5. Qualitative Findings

Thematic analysis of the 32 in-depth interviews generated four primary themes: perceived fiscal inequity and compliance rationalization, digital administration experience and trust formation, platform ecosystem as a compliance nudge environment, and the social embedding of compliance norms.

4.5.1. Theme 1: Perceived Fiscal Inequity and Compliance Rationalization

Across all three countries, non-compliant participants articulated their behavior through narratives of perceived inequity rather than straightforward evasion rationalization. Recurring arguments included the observation that large corporations paid proportionally less tax than small operators through avoidance arrangements, that visible corruption in government spending negated the value of compliance, and that the complexity of self-assessment procedures imposed costs that were disproportionate to the public services received. These rationalizations are consistent with the fiscal exchange hypothesis (Frey and Feld, 2002) and suggest that perceptions of system fairness, not merely individual financial calculus, are central to compliance decisions in this population. Bangladeshi participants expressed the most acute distrust of fiscal exchange, with several citing specific examples of local government project expenditures perceived as corrupt as direct justification for non-declaration.

4.5.2. Theme 2: Digital Administration Experience and Trust Formation

Mexican participants who had used the Regimen Simplificado de Confianza portal described a notably positive experience relative to the prior self-assessment regime, citing the pre-populated income data drawn from platform records as having dramatically simplified the declaration process and reduced anxiety about making calculation errors. Several noted that the availability of an accurate pre-populated return removed the most common rationalization for non-filing, namely procedural complexity and uncertainty about correct figures. This experiential evidence for the compliance-enhancing effect of digital administration quality through a complexity-reduction rather than a detection-amplification mechanism enriches the quantitative findings and points to taxpayer experience design as an underutilized policy lever.

4.5.3. Theme 3: Platform Ecosystem as a Compliance Nudge Environment

Several participants described platform operator behavior as an active factor in shaping compliance awareness. Platform applications in Mexico that integrated tax summary dashboards and year-end income statement generation were credited by multiple participants with making income totals visible in ways that removed the cognitive distancing from fiscal responsibility that cash-based income historically enabled. Moroccan participants noted that the Direction Generale des Impots communication campaign conducted through platform operator channels in 2023 had been more effective at generating compliance awareness than previous direct mail campaigns, suggesting that platform operators represent an underutilized compliance communication and nudge delivery channel.

4.5.4. Theme 4: Social Embedding of Compliance Norms

A distinctive qualitative finding was the extent to which compliance decisions were embedded in peer network dynamics within gig worker communities. Participants described online gig worker community forums and social media groups as primary sources of information about tax obligations and compliance strategies, including both legitimate guidance and non-compliance normalization. In contexts where non-compliance was the dominant peer norm within these communities,

participants described experiencing social pressure against full declaration, reinforcing the behavioral relevance of subjective norms and social capital in compliance decisions. This finding extends the social norms dimension of the SSF beyond formal institutional relationships to informal peer network dynamics that are particularly salient for the digitally connected gig worker population.

V. DISCUSSION

The findings of this study yield five theoretical and practical contributions to the behavioral tax compliance and public finance literatures. First, the primacy of tax morale over enforcement deterrence in explaining compliance intention among gig workers in developing countries (H1 supported, beta = 0.52 versus H3, beta = 0.27) challenges the dominant narrative in developing country revenue authority practice, which tends to prioritize audit and penalty intensification over trust-building and service quality investments as compliance improvement strategies. This finding extends Torgler's (2007) tax morale framework to the understudied gig worker population and confirms that intrinsic compliance motivation, while lower in absolute level than in advanced economy samples, remains the primary behavioral driver even in low-institutional-trust environments.

Second, the significant moderating effect of income transparency on the intention-behavior gap (H5 supported, interaction beta = 0.31) represents a novel empirical contribution that bridges the behavioral compliance and information economics literatures. The finding implies that digital platform payment record availability functions as a dual compliance mechanism: directly through deterrence by increasing the perceived probability of income detection, and indirectly through cognitive salience by making income totals visible in ways that reduce the psychological distance from fiscal responsibility. Revenue authorities in Mexico, Morocco, and Bangladesh should prioritize the regulatory frameworks necessary to leverage platform-generated income data in compliance enhancement strategies.

Third, the confirmation of tax morale as a significant mediator of the institutional trust-compliance intention relationship (H6 supported) has important implications for the sequencing of compliance improvement strategies. It implies that institutional trust-building, through transparent expenditure reporting, visible public service delivery, and procedurally fair administrative interactions, generates compliance dividends not only directly but also through the amplification of intrinsic compliance motivation. This indirect pathway means that trust-building investments compound over time as enhanced tax morale reinforces voluntary compliance independently of the level of institutional trust in any given period.

Fourth, the significant effect of digital tax administration quality on voluntary compliance intention (H4 supported, beta = 0.34), particularly in the Mexican context where operational experience with digital reforms was highest, provides valuable ex-post validation for developing country digital tax administration investments that have largely been justified on efficiency rather than behavioral grounds. The qualitative evidence on pre-populated return acceptance by Mexican participants identifies the specific mechanism through which digital administration quality generates compliance gains: complexity reduction removes the most common non-compliance rationalization, leaving intrinsic compliance motivation to operate without a procedural barrier.

Fifth, the cross-national variation in voluntary versus enforced pathway effectiveness supports H7 and has direct implications for the country-specific calibration of compliance strategies. Mexico's relatively higher institutional trust environment justifies a strategy weighted toward trust reinforcement, service quality investment, and digital administration enhancement. Bangladesh's lower-trust environment, while still responsive to voluntary pathway interventions, warrants a greater investment in consistent and visible enforcement to maintain credibility as a compliance deterrent. Morocco's intermediate institutional context argues for a balanced strategy combining digital administration investment with community-level tax education programs that leverage the social embedding of compliance norms documented in the qualitative findings.

VI. CONCLUSION

This study provides the first multi-country empirical evidence on the behavioral determinants of tax compliance among gig economy workers in developing countries, integrating the Slippery Slope Framework, tax morale theory, and behavioral public finance within a unified vignette-based experimental and structural analysis. The convergent findings from the vignette experiment and the observational structural model confirm that voluntary compliance motives, grounded in tax morale and institutional trust, are the primary drivers of gig worker compliance behavior across Mexico, Morocco, and Bangladesh, while enforcement deterrence, income transparency, and digital administration quality operate as significant but secondary or moderating factors.

For revenue authorities in developing countries confronting the fiscal challenges of gig economy expansion, the study offers five concrete recommendations. First, regulatory frameworks mandating platform operator income reporting to tax authorities should be treated as a policy priority, as the income transparency channel generates compliance returns through both deterrence and cognitive salience mechanisms. Second, digital administration reform programs should explicitly target compliance cost reduction through pre-populated return systems that draw on platform data, as the Mexican experience demonstrates that this approach removes the most common compliance barrier among gig workers with moderate tax morale. Third, tax authority communication strategies should systematically utilize platform operator channels as nudge delivery mechanisms, given the effectiveness of such channels documented in the Moroccan case. Fourth, anti-corruption transparency initiatives and visible public expenditure reporting should be treated as integral components of tax compliance strategy, as the fiscal exchange rationalization narrative documented in all three country contexts directly links perceived government integrity to compliance motivation. Fifth, tax morale cultivation through civic education programs targeting gig worker community networks and online forums should be piloted and evaluated, given the social embedding of compliance norms documented in the qualitative findings.

The study carries several limitations that define future research directions. The vignette-based behavioral intention measure, while validated and socially desirably less biased than direct compliance attitude questions, remains a proxy for

actual compliance behavior, and future research should validate these findings against administrative tax filing data through partnerships with revenue authorities. The sample is confined to urban gig workers accessible through platform operator referral networks and may not represent the full spectrum of informal gig work that falls outside formal platform registration. The cross-sectional design cannot capture the dynamic evolution of compliance behavior as digital administration reforms mature and trust-building initiatives accumulate. Longitudinal cohort studies tracking gig workers through successive tax filing cycles, combined with administrative data linkage, would provide the most rigorous evidence base for the behavioral tax policy interventions recommended in this study.

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