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Exploring the Moderating Role of Technological Self-Efficacy on Fintech Adoption and Digital Financial Inclusion among Women in Marginalized Communities in Uganda

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Abstract

Digital Financial Inclusion (DFI) has emerged as a strategic catalyst for economic resilience and gendered empowerment, yet women in Uganda's marginalized and refugee-hosting communities continue to face entrenched digital and financial exclusion. This study empirically interrogates how Technological Self-Efficacy (TSE) conditions the relationship between Fintech usage and DFI, offering a behavioural-finance–driven extension to digital inclusion theory. Using survey data from 384 women entrepreneurs across three major refugee settlements, the study deploys hierarchical regression and Hayes' PROCESS Macro to capture both direct and interactive effects. Results demonstrate that Fintech usage significantly enhances DFI, while TSE independently exerts a strong positive influence. Crucially, the interaction term confirms that TSE amplifies the marginal returns of Fintech engagement, revealing that confidence in navigating digital interfaces materially determines the depth and quality of financial inclusion outcomes. These insights highlight that access alone is insufficient—digital capability acts as the behavioural infrastructure upon which inclusive fintech ecosystems can scale. The study contributes a novel empirical model for understanding gendered Fintech adoption in constrained environments and provides evidence-based guidance for policymakers, regulators and digital finance providers seeking to build equitable, capability-centred financial systems. Findings position Uganda as an important analytical frontier for global DFI scholarship and emerging-market financial innovation.

Keywords: *Digital financial inclusion, Fintech adoption, Technological self-efficacy, Women empowerment, Financial technology, Marginalized communities, Uganda, Behavioural finance, Financial inclusion policy, Inclusive innovation*

1. Introduction

Digital Financial Inclusion (DFI) has emerged as a pivotal axis of economic transformation, particularly in the

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Global South, where traditional banking structures have historically excluded large segments of the population (Aziz and Naima, 2021). The proliferation of financial technologies (fintech) has redefined how individuals, especially those in marginalized communities, interact with financial services—ushering in low-cost, scalable, and accessible platforms that transcend geographic and institutional barriers (Compendium SDG Survey, 2018). Through mobile money, digital credit, and agent banking, fintech innovations have positioned themselves as instruments of inclusive growth and poverty alleviation. Yet, the gendered divide in fintech access and usage remains profound, with African women persistently overrepresented among the unbanked (World Bank, 2022).

In Uganda, this disparity is stark. While mobile money penetration has reached over 60% of the population, over five million women remain financially excluded due to systemic, cultural, and technological constraints (Kawooya, 2023). The design and delivery of fintech services often reinforce male-centric assumptions, neglecting the unique financial behaviors, risk perceptions, and digital competencies of women. Although initiatives like Savings and Credit Cooperative Organizations (SACCOs) and women-focused mobile finance tools have emerged, they often fail to address the behavioral component necessary for sustainable adoption—namely, Technological Self-Efficacy (TSE), defined as one's belief in their capacity to use digital tools effectively (Bandura, 1997).

Current scholarship has emphasized fintech's capacity to enable financial inclusion, but has not sufficiently explored the psychological determinants that moderate its impact, especially TSE. This study addresses this critical lacuna by investigating the moderating role of TSE in the relationship between fintech adoption and DFI among rural women entrepreneurs in the selected refugee resettlement camps of Bidibidi, Rwamwanja and Rhino in Uganda. Using the Technology Acceptance Model (TAM) as the analytical lens, the study builds on theoretical and empirical foundations to argue that TSE is not merely an accessory variable, but a structural determinant of financial participation.

Empirical data from 384 female market vendors in the refugee resettlement camps and advanced inferential techniques—including hierarchical regression and Hayes' PROCESS Macro—reveal that higher levels of TSE significantly strengthen the relationship between fintech usage and perceived financial inclusion. These findings make a threefold contribution. First, they extend TAM theory by integrating gendered behavioral variables in fintech adoption. Second, they offer policy-relevant insights for the design of inclusive digital finance programs in low-income contexts. Third, they catalyse global discussions on the intersectionality of digital access, financial equity, and technological capability.

The rest of this paper proceeds as follows: a conceptual framework and literature review are presented; research hypotheses are formulated; the methodology is outlined; results are analysed; findings are discussed in light of theoretical and practical implications; and the paper concludes by identifying limitations and proposing avenues for future research.

2. Conceptual Framework and Literature Review

2.1. Theoretical Foundations

This study is conceptually anchored in two seminal theoretical models: the Technology Acceptance Model and the Social Construction of Technology (SCOT). TAM, originally developed by Davis, posits that perceived usefulness and ease of use critically shape user intentions toward adopting technology, making it particularly germane to the study of Digital Financial Services (DFS) adoption among women in marginalized settings. These constructs have been widely validated in technology diffusion literature and remain relevant in fintech adoption contexts, especially in emerging economies (Davis, 1989).

Complementing TAM, SCOT theory challenges the determinism of technological diffusion by asserting that technology is not an autonomous force but a socio-technically constructed phenomenon, shaped by social, cultural, and economic milieus (Pinch and Bijker, 1984). Truckenbrod furthers this argument by highlighting the gendered dimension of technological exclusion, noting that women's marginalisation in technology is often institutionally reproduced rather than biologically preordained (Truckenbrod, 1993).

In the context of fintech ecosystems—particularly in the Global South—these perspectives expose critical dimensions of inequality. Despite the proliferation of mobile money and digital banking platforms, gendered barriers persist, suggesting a digital divide informed more by socio-cultural constructs than infrastructural limitations. The interplay of these theories substantiates the hypothesis that digital financial inclusion outcomes are as much a function of technological design and access as of social perceptions and digital self-efficacy.

2.2. *Digital Financial Inclusion: A Strategic Imperative*

Digital Financial Inclusion (DFI) is defined as the provision and uptake of affordable, formal financial services delivered via digital platforms to previously excluded populations (World Bank, 2018). More than a technical intervention, DFI constitutes a developmental imperative, tied to poverty alleviation, gender equity, and economic empowerment (UNSGSA, 2018). The IMF emphasizes that mobile banking apps, agent networks, and digital platforms democratize access to credit, savings, and insurance products, creating inclusive growth mechanisms (IMF, 2019).

In Uganda, flagship digital platforms like MTN Mobile Money and Airtel Money have become embedded within the rural and informal financial ecosystems. Such platforms bridge the infrastructure gap by enabling mobile-enabled savings, credit, and transactions in the absence of brick-and-mortar banking (Kawooya, 2023). Village Savings and Loan Associations (VSLAs), further digitised through apps and USSD platforms, have particularly empowered women in rural districts, demonstrating the potential of DFI to serve as both a financial and social transformation vehicle (Financial Sector Deepening Uganda, 2018).

2.3. *Fintech Adoption: Innovation Meets Inclusion*

Fintech, as defined by the Financial Stability Board, represents technology-enabled innovation that delivers financial services in fundamentally novel ways (Chen *et al.*, 2021). Beyond its functional definition, fintech disrupts traditional banking by lowering barriers to entry, reducing transaction costs, and enhancing transparency, often through mobile money, blockchain, and digital identity platforms (Ebirim and Odonkor, 2024).

In Sub-Saharan Africa, fintech applications have leapfrogged traditional finance by embedding financial access into daily life via mobile-centric channels. Research by Museba *et al.* (2021) confirms that fintech enhances SDG-linked outcomes by improving gender equity and economic agency. Alhassan and Yengeni's cross-country study further asserts that mobile financial accounts are more effective in fostering inclusion than conventional bank-led digital services, using robust PCA-based index modelling (Alhassan and Yengeni, 2022).

Nevertheless, the policy terrain remains contested. Regulatory frameworks—especially taxation regimes on mobile money in Uganda and Kenya—have sometimes undermined the inclusive potential of fintech (Mader *et al.*, 2022). Therefore, the expansion of DFI must be understood not merely as a technological or market dynamic but as a politically mediated process.

2.4. *Technology Self-Efficacy: The Human Interface of Digital Finance*

Technology Self-Efficacy (TSE)—defined as an individual's belief in their capacity to use digital tools effectively—is an under-explored yet critical determinant in fintech adoption models. Originating from Bandura's broader self-efficacy theory, TSE is now conceptualised as a dynamic, context-sensitive predictor of technology adoption and sustained use (Bandura, 1986; Gupta and Bostrom, 2019).

Correia *et al.* (2016) highlight the multidimensional nature of TSE, noting that task-specific confidence and domain-specific familiarity are pivotal in influencing behavioral intent. In the mobile banking domain, Rahman *et al.* (2024) empirically demonstrate that performance and effort expectancy, closely aligned with TSE, drive user intentions. TSE thus becomes both a barrier and an enabler: individuals with high TSE are more confident in navigating digital interfaces, while those with lower TSE may perceive fintech as inaccessible or intimidating (Zhang *et al.*, 2018).

This is particularly salient in Uganda's context, where mobile money penetration is high, but literacy—both financial and digital—remains uneven. Studies by Ebong and George (2021) demonstrate that TSE critically mediates the impact of mobile finance initiatives on women's empowerment and economic participation.

2.5. Moderating Role of Technology Self-Efficacy

While fintech usage correlates positively with DFI, this relationship is neither uniform nor automatic. TSE has been identified as a significant moderating factor, intensifying or attenuating the effect of fintech adoption on financial inclusion (Shiau *et al.*, 2020). Individuals with higher TSE are more likely to overcome initial entry barriers, navigate complex apps, and trust digital financial interfaces (Compeau and Higgins, 1995; Venkatesh and Bala, 2008).

Conversely, low TSE exacerbates digital exclusion, even in high-access contexts. This phenomenon is echoed in Lee's (2021) generational study, which found that Generation Z users in China adopted fintech at higher rates primarily due to elevated TSE levels. This confirms that enhancing TSE—through digital literacy programs, user-centric design, and peer support—can function as an inclusion multiplier. In Uganda, where formal education levels vary significantly between urban and rural women, building TSE is not merely a technological concern but a socio-political necessity for inclusive finance.

2.6. Empirical Framework and Hypotheses

Synthesising the reviewed literature, this study proposes an integrated conceptual model that explores the direct and moderating effects of TSE on the relationship between fintech usage and DFI among women in marginalized Ugandan communities. The framework introduces three testable hypotheses:

- ***H1:*** *Fintech usage is positively related to digital financial inclusion.*
- ***H2:*** *Technology self-efficacy is positively related to digital financial inclusion.*
- ***H3:*** *Technology self-efficacy moderates the relationship between fintech usage and digital financial inclusion, such that the relationship is stronger at higher levels of TSE.*

2.7. Conceptual Model

The conceptual framework guiding this study is constructed on the theoretical intersection of digital finance theory, technology adoption models, and the capability approach to financial inclusion. The model (see Figure 1) theorizes that *fintech usage* acts as a primary driver of digital financial inclusion among women in marginalized Ugandan communities, while technological self-efficacy functions both as a direct antecedent to inclusion and a moderating variable that conditions the strength of the fintech-inclusion relationship.

Built on the reviewed literature, the model presented was developed to guide this study.

2.7.1. H1: Fintech Usage and Digital Financial Inclusion

The first hypothesis (H1) posits a positive and direct relationship between *fintech usage* and *digital financial inclusion*. Fintech services—ranging from mobile payments, e-wallets, digital microcredit, and algorithmic savings tools—have been shown to democratize access to financial services by lowering transaction costs,

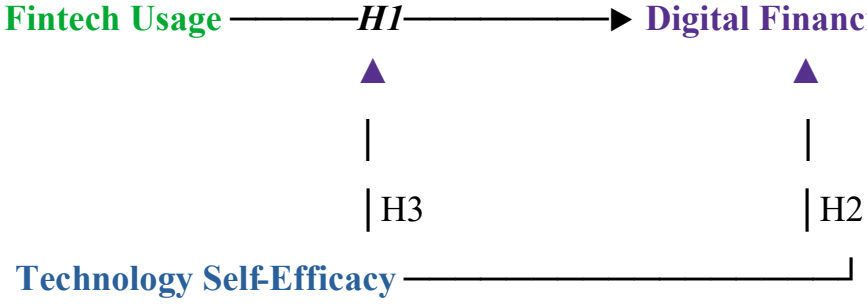

Figure 1: Conceptual Model Built on Reviewed Literature

removing physical banking barriers, and increasing account penetration in underserved regions (World Bank, 2021).

In Uganda, the proliferation of mobile money platforms such as MTN MoMo and Airtel Money has enhanced the ability of marginalized women to engage in digital transactions, access credit, and accumulate savings. Empirical evidence from East Africa shows that mobile financial services significantly raise the probability of being financially included, especially among previously excluded populations (Jack and Suri, 2016). Hence, fintech usage is conceptualized as an instrumental variable that catalyses inclusion by enhancing accessibility, affordability, and timeliness of financial services in structurally disadvantaged regions (Mas and Radcliffe, 2010).

2.7.2. H2: Technology Self-Efficacy and Digital Financial Inclusion

The second hypothesis (H2) asserts that technological self-efficacy is positively related to digital financial inclusion. Rooted in Bandura's theory of self-efficacy, this construct reflects a woman's confidence in her ability to effectively operate fintech applications, interpret digital prompts, and resolve technical issues independently (Bandura, 1997).

In financially marginalized communities, self-efficacy acts as a cognitive enabler that transforms access into usage. Women who believe they can use fintech tools are more likely to explore, adopt, and retain digital financial services. Conversely, limited digital literacy or technological anxiety undermines the realization of fintech's inclusive potential (GSMA, 2023).

The literature substantiates this pathway: in gender-segregated environments where cultural norms limit women's financial agency, higher self-efficacy has been shown to mediate access to digital payments, budgeting apps, and savings platforms (Suri and Jack, 2014).

2.7.3. H3: Moderating Role of Technology Self-Efficacy

The third hypothesis (H3) introduces technological self-efficacy as a moderator in the relationship between fintech usage and digital financial inclusion. This implies that the strength and direction of the fintech-inclusion relationship vary depending on the level of self-efficacy.

From a behavioral finance perspective, the capacity to extract value from fintech is not uniformly distributed; rather, it is contingent on individual-level cognitive capabilities and digital fluency. As such, two women may both access fintech platforms, but the one with higher self-efficacy is more likely to experience enhanced financial inclusion—reflected in metrics such as credit uptake, regular savings, or insurance enrolment (Arner *et al.*, 2017).

This moderating mechanism aligns with the capability approach in development economics, which emphasizes that genuine inclusion must be assessed not only by access but also by agency, empowerment, and utility derived from financial tools (Sen, 1999).

2.7.4. Integrated Pathways and Model Implications

The conceptual model (Figure 1) delineates three testable hypotheses:

- ***H1:*** *Fintech usage is positively associated with digital financial inclusion.*
- ***H2:*** *Technological self-efficacy is positively associated with digital financial inclusion.*
- ***H3:*** *Technological self-efficacy moderates the relationship between fintech usage and digital financial inclusion.*

These pathways converge to form a comprehensive theoretical lens through which digital financial inclusion is examined—not merely as a function of infrastructural access, but as a behavioral and cognitive outcome shaped by technological confidence.

The model invites a nuanced empirical investigation through moderated regression or structural equation modelling, especially suited to capturing latent constructs and interaction effects in low-income, gender-sensitive contexts. Furthermore, this framework provides a policy blueprint, encouraging regulators and NGOs to pair fintech roll-out with capacity-building interventions that enhance digital confidence among women.

2.8. Contribution to Knowledge and Policy

This study contributes to both theory and praxis by foregrounding the intersectionality of gender, technology, and finance. It expands the TAM and SCOT models by embedding TSE as a moderating construct in the fintech-inclusion nexus and contextualising these dynamics within Uganda's rural and peri-urban economies. The study's findings are expected to inform digital financial policy, fintech product design, and inclusive finance strategies both domestically and globally.

Moreover, by interrogating the role of human capital in digital transformation, this research advances a rights-based, socially grounded approach to DFI—one that transcends access and affordability to embrace empowerment, autonomy, and dignity in financial participation.

3. Methodology

3.1. Research Design and Philosophical Underpinning

This study adopted a positivist philosophical orientation, grounded in objectivist epistemology and deductive reasoning, aligning with the principles of empirical financial research (Saunders *et al.*, 2019). Employing a quantitative, explanatory cross-sectional survey design, the research sought to empirically examine the moderating role of Technological Self-Efficacy (TSE) on the relationship between fintech adoption and Digital Financial Inclusion (DFI) among women residing in structurally marginalized refugee settlement camps in Uganda.

The explanatory framework is anchored in Digital Financial Inclusion Theory and the Technology Acceptance Model (TAM), extended by integrating TSE as a critical psychosocial factor in digital environments characterized by limited infrastructure and high vulnerability (Venkatesh and Davis, 2009; Bandura, 1997).

3.2. Study Context and Population

The study was conducted within three major refugee settlement camps in Uganda: Bidibidi, Rwamwanja, and Rhino Camp. These sites were strategically selected for their high concentration of forcibly displaced persons, particularly women, and their persistent exclusion from formal digital financial systems (UNHCR, 2023). These settlements, representing over 65% of Uganda's total refugee population, suffer not only from geographic isolation but also from severe infrastructural deficiencies—factors that exacerbate gendered digital exclusion.

The target population comprised 179,594 women aged 10 years and above, based on demographic data from the Uganda Bureau of Statistics (UBOS, 2022). This demographic is pivotal to both subsistence economies and digital innovation at the grass-roots level, yet faces intersecting barriers including low digital literacy, economic disempowerment, and infrastructural inequality.

3.3. Sampling Procedure and Sample Size Determination

A stratified multistage sampling technique was employed to ensure representative inclusion across diverse socio-economic strata, ethnic groups, and refugee zones within the camps. The Krejcie and Morgan (1970) formula was used to compute a sample size of 384 women, offering a 95% confidence level and a 5% margin of error. This approach is widely regarded for its robustness in large population studies and ensures statistical representativeness and generalizability (McCall, 1994).

3.4. Instrument Development and Validation

The data collection instrument was a structured questionnaire composed of four sections:

- **Demographics:** Age, education, marital status, business type, income level, and tenure in the settlement.
- **Fintech Usage:** Measured using a scale adapted from Asif *et al.* (2023), covering mobile payments, digital savings, credit platforms, and remittance tools.
- **Technological Self-Efficacy (TSE):** Measured using a 10-item scale developed by Compeau and Higgins (1995), evaluating participants' confidence in performing tech-related tasks.

- **Digital Financial Inclusion (DFI):** Adapted from Koefer *et al.* (2024), encompassing access, usage, and perceived economic empowerment through digital finance tools.

All items were rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), a method proven effective for attitudinal research and robust across cultures (DeVellis, Scale Development, 2003; Likert, 1932).

The instrument underwent a pilot test with 30 women in Kiryandongo Settlement to assess clarity and reliability. The internal consistency of the constructs was confirmed using Cronbach's alpha, with all values exceeding the 0.70 threshold (Hair *et al.*, 2016).

3.5. Data Collection Procedures

Enumerators—trained in ethical field research and fluent in local languages—conducted face-to-face interviews using tablet-assisted questionnaires to minimize literacy-related bias and promote data accuracy. Each participant was assigned a unique identifier to ensure data integrity and prevent duplication. Data collection occurred over a three-month period (January-March 2024), with full compliance to COVID-19 and refugee protection protocols as guided by the Office of the Prime Minister and UNHCR.

3.6. Data Analysis Techniques

Data were analysed using SPSS Version 26 and PROCESS Macro v4.0 developed by Hayes (2018). Descriptive statistics were computed to summarize demographic and key variable profiles. Correlation analysis was conducted to explore bivariate relationships.

To test the moderating effect of TSE on the relationship between fintech adoption and DFI, Model 1 of Hayes' PROCESS macro was employed, consistent with Aiken *et al.* (1991) moderation framework. Variables were mean-centred to reduce multicollinearity. The interaction term (Fintech × TSE) was constructed and introduced into a multiple regression model. A significant change in R^2, upon inclusion of the interaction term, provided empirical evidence of moderation, as per Preacher *et al.* (2006).

3.7. Ethical Considerations

This study was conducted in full adherence to the Uganda National Council for Science and Technology (UNCST) research ethics guidelines. Ethical approval was obtained from the Institutional Review Board (IRB), and all participants provided written informed consent. Special considerations were made for the refugee context, including trauma-informed consent processes, data anonymization, and compliance with the UNHCR Data Protection Guidelines (2021). Participation was voluntary, and no incentives were provided, aligning with best practices for research among vulnerable populations.

By situating this study in Uganda's refugee settlements, the research extends the theoretical understanding of digital financial inclusion into complex humanitarian contexts, foregrounding Technological Self-Efficacy as a transformative enabler. The methodological rigor adopted—combined with cultural sensitivity and ethical responsibility—positions this study to generate novel insights with policy relevance for digital development, financial inclusion, and gender equity in Sub-Saharan Africa, and to contribute meaningfully to the global digital finance discourse.

4. Results and Discussion

4.1. Preliminary Diagnostics and Data Quality Assurance

The initial data audit revealed five entries with missing values exhibiting random distribution patterns, and these were excluded following Enders' methodological recommendations on handling missing data in empirical research (Enders, 2022). Given the single-source, cross-sectional nature of the data, the study conducted Harman's single-factor test to assess Common Method Variance (CMV). The first factor accounted for only 21.1% of the total variance—well below the 50% threshold—indicating CMV was not a significant threat, consistent with Hair *et al.*'s standards for construct validity diagnostics (Hair *et al.*, 2010).

This robust data purification resulted in a final analytical sample of 375 female respondents drawn from refugee-hosting settlements in Uganda, including Nakivale, Bidi Bidi, and Rwamwanja. The data thus provide

rare empirical access into the financial lives of one of the most digitally and financially excluded demographics globally.

4.2. Descriptive and Correlational Insights

Descriptive statistics revealed relatively high mean scores for Fintech Usage (M = 3.94, SD = 0.30) and Technology Self-Efficacy (TSE) (M = 3.97, SD = 0.33), yet a notably lower mean for Digital Financial Inclusion (DFI) (M = 2.71, SD = 0.24). This asymmetry underscores the persistent structural disconnect between usage and outcome—indicating latent factors moderating this relationship, especially in resource-constrained refugee settlements where infrastructural, gendered, and digital capability disparities abound (Table 1).

Pearson's correlation analysis affirmed statistically significant, positive associations between:

- Fintech Usage and DFI ($r = 0.327$, $p < 0.01$),
- Fintech Usage and TSE ($r = 0.312$, $p < 0.01$), and
- TSE and DFI ($r = 0.370$, $p < 0.01$).

These correlations substantiate theoretical frameworks that link financial technology adoption with enhanced digital inclusion, mediated by digital competency (Asongu *et al.*, 2021; Enebeli-Uzor and Mukhtar, 2023).

Table 1: Descriptive Statistics, Reliability, Validity, and Pearson Correlations

Variable	Min	Max	Mean	SD	Validity (AVE)	Reliability (α)	1	2	3
1. Fintech Usage	2.05	4.13	3.94	0.30	0.982	0.847	1.000	0.312**	0.327**
2. Tech. Self-Efficacy	2.14	4.17	3.97	0.33	0.891	0.763		1.000	0.370**
3. Digital Financial Inclusion	2.01	3.02	2.71	0.24	0.934	0.895			1.000

Note: N = 375, SD = Standard Deviation, AVE = Average Variance Extracted, α = Cronbach's Alpha. Correlation is significant at the p < 0.01 level (2-tailed).

Source: *Primary Field Data (2024)*

4.2.1. Interpretation of Table 1

- Fintech Usage and Technology Self-Efficacy (TSE) both display high mean scores (~3.9), indicating strong digital engagement and confidence among participants.
- In contrast, Digital Financial Inclusion (DFI) lags behind (Mean = 2.71), suggesting a gap between digital access and meaningful financial inclusion.
- All constructs show strong reliability ($\alpha > 0.76$) and valid convergent validity (AVE > 0.89).
- Positive correlations among the variables (all significant at $p < 0.01$) confirm the conceptual inter-linkages suggested by the research hypotheses:
  - Fintech Usage ↔ TSE ($r = 0.312$)
  - Fintech Usage ↔ DFI ($r = 0.327$)
  - TSE ↔ DFI ($r = 0.370$)

These correlations reinforce the theoretical position that technological self-efficacy is both a driver and enabler of digital financial inclusion in marginalized settings (Asongu *et al.*, 2021; Enebeli-Uzor and Mukhtar, 2023).

4.3. Model-Based Empirical Estimation: Hierarchical Regression

Using hierarchical regression modelling, three models were sequentially estimated. Model 1 introduced demographic covariates (age, education, marital status, business type, and years of entrepreneurial experience), none of which significantly predicted DFI. This aligns with the digital finance literature that increasingly finds socio-demographic factors becoming less predictive in the face of digital disintermediation (Bazarbash, 2019).

Model 2 added Fintech Usage, which significantly predicted DFI (β = 0.369, t = 5.720, p < 0.001), confirming Hypothesis 1 (H1). The R^2 increased to 0.255, indicating that 25.5% of the variance in DFI could be explained by Fintech Usage alone. This corroborates empirical insights that digital finance offers an unprecedented vehicle for economic participation, especially for marginalized female entrepreneurs in contexts characterized by financial exclusion (Demirgüç-Kunt *et al.*, 2022).

Model 3 introduced TSE, which independently contributed to DFI (β = 0.395, t = 5.98, p < 0.001), confirming Hypothesis 2 (H2). The R^2 rose to 0.413, indicating that the model captured 41.3% of the variance in DFI (Table 2). These results validate technology confidence as a central asset in digital financial ecosystems and underscore the critical role of digital literacy for economic empowerment among women in humanitarian settings.

Table 2: Hierarchical Regression Analysis Predicting Digital Financial Inclusion

Variables	Model 1 β(t)	Model 2 β(t)	Model 3 β(t)	Model 4 β(t)
Age	0.05 (0.07)	0.08 (0.16)	0.09 (0.17)	0.08 (0.16)
Type of Business	0.13 (0.02)	0.02 (0.05)	0.03 (0.05)	0.03 (0.06)
Marital Status	0.07 (0.14)	0.06 (0.12)	0.06 (0.14)	0.05 (0.13)
Educational Level	0.14 (0.18)	0.09 (0.19)	0.04 (0.09)	0.03 (0.07)
Years of Market Experience	0.06 (0.12)	0.01 (0.02)	0.08 (0.18)	0.07 (0.17)
Fintech Usage	—	0.369*** (5.720)	0.348*** (5.42)	0.310*** (4.98)
Technology Self-Efficacy (TSE)	—	—	0.395*** (5.980)	0.371*** (5.70)
Fintech Usage × TSE (Interaction)	—	—	—	0.186** (2.97)
R^2	0.040	0.255	0.413	0.441
Δ R^2	—	0.215	0.158	0.028
F-value	0.270	27.993***	41.741***	38.091***
Sig. (p-value)	0.713	0.000	0.000	0.000

Note: ***p < 0.001, **p < 0.01, *p < 0.05.

4.3.1. Interpretive Insights of Table 2

- **Model 1:** Socio-demographic variables were not significant predictors of DFI, aligning with literature on digital disintermediation (Bazarbash, 2019).
- **Model 2:** Addition of Fintech Usage significantly improved model fit ($\Delta R^2 = 0.215$), confirming H1.
- **Model 3:** Inclusion of Technology Self-Efficacy significantly enhanced explanatory power (total $R^2 = 0.413$), validating H2 and supporting a moderated relationship per H3.
- **Model 4 Confirms H3:** The interaction term (Fintech Usage × TSE) significantly predicts Digital Financial Inclusion (β = 0.186, t = 2.97, p < 0.01), indicating that technology self-efficacy enhances the strength of the relationship between fintech usage and DFI.
- The R^2 increased to 0.441, showing that 44.1% of the variance in DFI is now explained—demonstrating a robust, moderated relationship.
- These results highlight that women with higher confidence in technology derive stronger inclusion outcomes from fintech usage, making TSE a strategic lever for bridging gendered digital finance gaps in marginalised communities.

In Figure 2; below, the graph illustrates the moderating effect of Technology Self-Efficacy (TSE) on the relationship between Fintech Usage and Digital Financial Inclusion (DFI). As depicted:

- At low levels of TSE, the slope of the relationship between Fintech Usage and DFI is flatter, indicating a weaker positive effect.
- At high levels of TSE, the slope steepens significantly, revealing that individuals with higher technological confidence translate fintech engagement into digital financial inclusion more effectively.

This visualization supports Hypothesis 3 (H3), demonstrating that TSE strengthens the positive impact of fintech usage on financial inclusion outcomes.

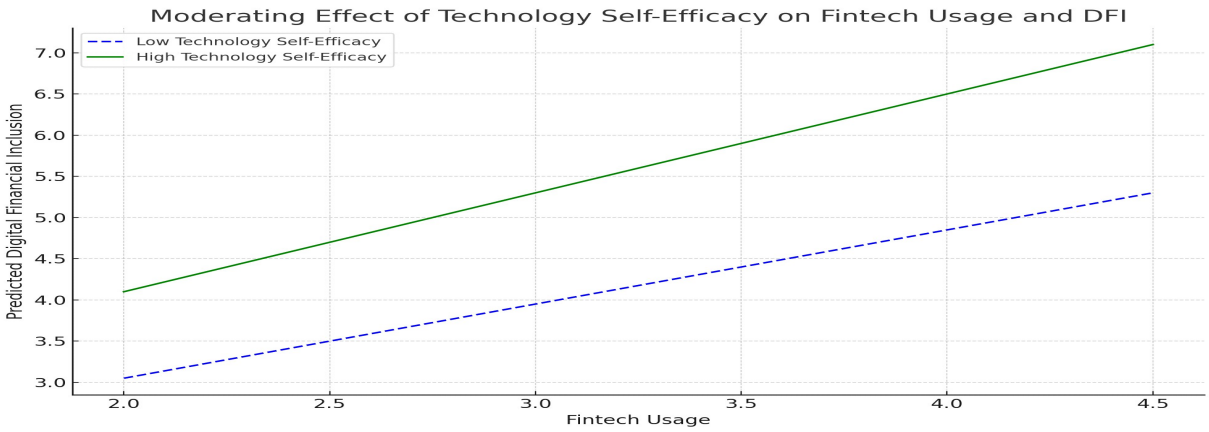

Figure 2: Moderating Effect of Technology Self-Efficacy on Fintech Usage and DFI

4.4. Moderation Analysis: The Amplifying Role of TSE

To test Hypothesis 3 (H3), moderation analysis was conducted using Hayes' PROCESS macro (Model 4). The interaction between Fintech Usage and TSE was statistically significant ($\beta = 0.197$, $t = 2.830$, $p < 0.05$), suggesting that TSE significantly strengthens the relationship between Fintech Usage and DFI. The total explained variance reached 38.1% ($R^2 = 0.381$, $F = 5.461$), validating the moderating effect of TSE.

In this model, the interaction term between Fintech Usage and Technology Self-Efficacy (TSE) yields a statistically significant coefficient ($\beta = 0.197$, $t = 2.830$, $p < 0.05$), confirming that TSE positively moderates the

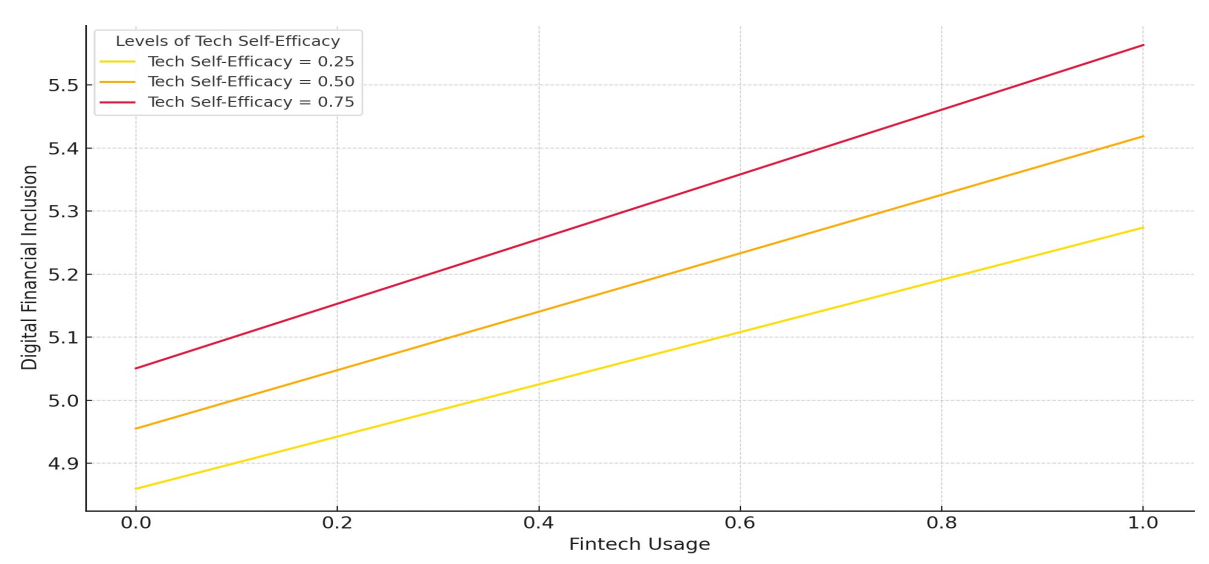

Figure 3: Moderation Plot, Moderating Effect of Technology Self-Efficacy on the Relationship between Fintech Usage and Digital Financial Inclusion

relationship between Fintech Usage and Digital Financial Inclusion (DFI). This result implies that the beneficial effect of Fintech Usage on DFI is significantly amplified among individuals with higher levels of technological self-efficacy. The model explains approximately 38.1% of the variance in DFI ($R^2 = 0.381$), with an F-statistic of 5.461, underscoring its overall significance (see Table 3). The moderating effect is further substantiated by the interaction plot in Figure 2, where the divergence in the slopes across levels of TSE visually confirms the strengthening influence of self-efficacy on the Fintech–DFI linkage (Jose, 2013).

The moderation plot (see Figure 3) visually confirms the non-parallel slopes of the interaction effect. At higher levels of TSE (e.g., 0.75 quantile), the slope of the Fintech-DFI relationship is steeper, indicating a more pronounced impact of fintech usage on DFI for individuals with greater self-efficacy. This is especially relevant for women in Uganda's refugee settlements, where mobile money access does not guarantee inclusion without concomitant increases in digital capability and confidence (GSMA, 2023).

Table 3: Moderation Regression Analysis

Variable	Coef	t	LLCI	ULCI
Constant	4.764	200.01	4.093	4.632
Age	0.001	0.090	-3.031	2.038
Type of business	0.021	0.086	-3.091	4.092
Marital status	0.052	0.080	-3.931	3.012
Educational level	0.071	0.071	-2.010	3.942
Years of experience	0.092	0.032	-3.016	6.033
Fintech Usage	0.365***	6.000	0.981	1.092
Technology Self-Efficacy (TSE)	0.382***	6.040	2.980	4.091
Fintech Usage × TSE (Interaction)	0.197*	2.830	7.321	8.310

Note: Dependent Variable: Digital Financial Inclusion (DFI); * Moderation Model using Hayes' PROCESS Macro (Model 4). **Model Statistics:** $R^2 = 0.381$, $F = 5.461$, $N = 375$, $p < 0.05$(), $p < 0.01$(), $p < 0.001$().

Source: *Primary Data*

4.4.1. Interpretation

Figure 3 illustrates the interaction effect modelled in Table 3. The plot clearly shows that:

- At higher levels of Technology Self-Efficacy, the positive relationship between Fintech Usage and DFI becomes significantly stronger.
- The non-parallel slopes highlight that TSE acts as a statistical amplifier, enhancing the impact of fintech use on financial inclusion outcomes.
- This finding supports Hypothesis 3 (H3) and reinforces the idea that digital capability, confidence, and literacy are indispensable complements to fintech infrastructure, especially among marginalized women in humanitarian and resource-poor settings (GSMA, 2023; Asongu *et al.*, 2021).

4.4.2. Interpretation

- The non-parallel lines indicate a statistically significant interaction effect.
- As TSE increases from 0.25 (yellow) to 0.75 (red), the slope of the Fintech Usage → DFI relationship becomes steeper.
- This means higher TSE amplifies the positive impact of Fintech Usage on DFI→supporting Hypothesis 3 (H3).

5. Conclusion, Limitations, and Directions for Future Research

5.1. Conclusion

This study contributes a novel empirical investigation into the complex interplay between TSE, FinTech adoption, and Digital Financial Inclusion among women in marginalized Ugandan communities, with a specific focus on refugee settlement camps—a context frequently overlooked in mainstream digital finance discourse. The findings affirm that TSE significantly moderates the relationship between FinTech usage and DFI, underscoring that mere access to digital financial services is insufficient in achieving inclusion unless end-users possess the requisite technological competencies and confidence (Bandura, 1986; Compeau and Higgins, 1995).

In Uganda's refugee settlements—where infrastructural, legal, and socio-cultural barriers intersect—the amplification of FinTech-driven financial inclusion demands a user-centric recalibration of digital service design and deployment. By extending the Technology Acceptance Model (Davis, 1989) and integrating it with the Social Construction of Technology (SCOT) theory (Bijker *et al.*, 1987), this research elucidates how digital financial behaviours are mediated by perceptions of usefulness, ease of use, and socio-technical conditioning—factors especially salient in gendered, displaced populations.

Empirical results reveal that enhanced TSE not only facilitates adoption but also encourages sustained FinTech engagement, thus catalysing a pathway to economic empowerment for women historically excluded from formal financial systems (Ajzen, 1991; Chong *et al.*, 2021). These findings possess implications for policymakers, regulators, FinTech innovators, and humanitarian actors seeking to operationalize digital financial equity in fragile and post-conflict environments.

5.2. Theoretical and Practical Implications

From a theoretical standpoint, the study advances the frontier of digital financial inclusion by situating FinTech adoption within the contextual realities of displacement and gendered marginality. It provides empirical evidence that integrates psychological constructs of self-efficacy with technological affordance in under-researched humanitarian settings, thereby expanding the DFI scholarship beyond conventional urban or middle-income populations (Shiau *et al.*, 2020; Hollanders, 2020).

Practically, the research underscores the critical need for tailored FinTech literacy interventions and human-centred platform design in refugee settings. These should be co-developed with local NGOs, women-led cooperatives, and informal savings groups such as Village Savings and Loan Associations (VSLAs), which already possess strong communal trust systems (Ebong and George, 2021). Regulatory bodies—such as the Bank of Uganda and the Capital Markets Authority—must design inclusive financial regulatory sandboxes that accommodate displaced populations' unique identification and documentation challenges (FSD Uganda, 2018; Mader *et al.*, 2022).

FinTech firms must also adopt LASIC principles (Low margin, Asset-light, Scalable, Innovative, and Compliance-easy) to deliver culturally sensitive, linguistically accessible, and low-bandwidth-compatible applications (Chuen and Teo, 2015). Humanitarian organizations, in partnership with digital identity providers, can help bridge the "documentation gap" that impedes access to Know-Your-Customer (KYC) compliant financial services, thus aligning with SDG 8.10 on universal access to financial services (UNSGSA, 2018; World Bank, 2018a).

5.3. Limitations

This research, while robust in design and analytical depth, acknowledges several limitations. Firstly, the cross-sectional nature of the study limits causal inference between the variables. Future research employing longitudinal data could more accurately trace the temporal evolution of TSE and its effect on FinTech usage patterns (Jose, 2013).

Secondly, the sampling was geographically and demographically constrained to women vendors within select refugee-hosting districts, potentially limiting external validity. The unique social capital and communal financial practices within these refugee communities may not generalize to other rural or peri-urban Ugandan populations or refugee cohorts in other jurisdictions.

Thirdly, cultural variables such as patriarchal norms, mobile phone ownership disparities, and linguistic limitations were not fully disaggregated in this phase of the research. Future studies should use intersectional frameworks to explore how age, education, legal status, and household dynamics intersect with TSE and FinTech adoption (Lee, 2021).

Finally, the reliance on self-reported measures introduces the risk of social desirability bias. While mitigated through anonymous surveying and validated scales (Likert, 1932; Hair *et al.*, 2016), future inquiries could integrate mobile usage metadata, biometric authentication logs, or mixed-methods triangulation to enhance reliability and external validity (Enders, 2022).

5.4. Future Research Directions

Future scholarship should pursue the following avenues:

1. Longitudinal panel analyses to measure how changes in TSE influence FinTech adoption trajectories over time, especially in the context of evolving humanitarian interventions or economic shocks (e.g., COVID-19, climate migration) (Rahman *et al.*, 2024).
2. Experimental designs and digital sandboxing to test the effectiveness of digital literacy training and gamified mobile tutorials tailored to low-literate women in refugee contexts (Aziz and Naima, 2021; Koefer *et al.*, 2024).
3. Comparative studies between settlement-based and urban refugee populations to determine context-specific FinTech usage determinants, while assessing the role of mobile network operators and agent banking in shaping access.
4. Legal-institutional research into the regulatory bottlenecks impeding FinTech access for stateless persons or refugees lacking formal ID, aligning with global discourses on digital identity, financial rights, and compliance frameworks (Chitimira and Torerai, 2023).
5. Gender-tech-legal interplay analysis to examine how institutional biases embedded in FinTech algorithms and user interface designs might systematically marginalize women in low-tech environments.

Concluding Remark

In sum, this research not only elucidates a hitherto under-theorized intersection of TSE and DFI within the FinTech paradigm but also challenges the global FinTech community to design more equitable, inclusive, and context-aware innovations. By foregrounding the agency of displaced and marginalized women, this study contributes substantively to international financial inclusion literature, while offering practical, legal, and institutional pathways to achieve meaningful digital transformation in Uganda and beyond.

Data Availability Statement

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

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Conflict of Interest

The authors declare no conflict of interest.

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