Influence of Perceived Mobile Financial Services Risk and Usefulness on Digital Financial Inclusion of Low–Income Individuals in Tanzania

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Abstract: Digital Financial Inclusion (DFI) plays a critical role in empowering underserved communities by providing access to essential financial services, thereby fostering their social and economic development. This study was designed to address two themes: The extent to which Perceived Risks (PR) and Perceived Usefulness (PU) influence DFI among low-income individuals. Secondly, how PR moderates the relationship between PU and DFI. Drawing data from 283 microfinance banks clients in Arusha and Dar es Salaam, Tanzania, the study employed the Partial Least Squares Structural Equation Modelling (PLS-SEM) for statistical analysis. Descriptive findings highlighted moderate PR concerns, especially regarding transaction security and errors while PU was rated highly for its perceived benefits in saving time, reducing costs and improving financial management. Inferential analysis revealed that PU had a substantial and statistically significant positive effect on DFI whereas PR exhibited no direct influence nor moderating role in the PU–DFI relationship. These results suggest that enhancing the PU of Mobile Financial Services (MFS) can significantly drive DFI even in the presence of moderate risk concerns. The study underscores the need for targeted strategies to promote MFS usability and security, particularly for low-income users in developing economies. Future research should explore evolving risk dynamics and technological innovations to proactively monitor and address emerging risks in DFI.

Keyword: Digital financial inclusion; mobile financial services; perceived risks; perceived usefulness.

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Introduction

Digital Financial Inclusion (DFI) is a multi-dimensional concept, encompassing access to, usage of and the quality of Digital Financial Services (DFS) (Demirguc-Kunt et al., 2018; WB, 2021). It plays a critical role in integrating unbanked populations into formal financial systems, fostering economic empowerment and development (Yawe et al. 2022; Ozturk & Ullah, 2022). The global adoption of DFS, powered by mobile devices and the internet, has accelerated due to technological advancements and increasing demand for accessible financial solutions (Kamuangu, 2024; Ololade, 2024; Appaya & Shaikh, 2024). However, financial exclusion remains a challenge, particularly in Sub-Saharan Africa, where large portions of the population still lack access to formal financial services (Segning et al., 2024; Chinoda & Kapingura, 2024). Despite global declines in financial exclusion (WB, 2021), Sub-Saharan Africa remains the region with the highest proportion of unbanked adults (WB, 2022; Kamran & Uusitalo, 2016). According to Kamran and Uusitalo (2016), unbanked adults are characterized by their economic vulnerability and lack of access to formal banking services, such as savings accounts or secure financial tools for managing daily transactions. The exclusion exacerbates their financial instability, especially among low-income groups.

Availability and quality of DFS have potential to drive economic growth and alleviate poverty and health related challenges (Mpofu, 2023; WB, 2021).

Mobile Financial Services (MFS), delivered via mobile phones, became particularly valuable during the COVID-19 pandemic, facilitating essential transactions amid mobility restrictions (Mugume & Bulime, 2022; WB, 2021). They also offer low-income communities in developing countries a cost-effective alternative to traditional banking (Shaikh & Karjaluoto, 2015; Jack & Suri, 2014). According to the Technology Acceptance Model (TAM), Perceived Usefulness (PU) of MFS is a key driver for adoption and continued usage, emphasizing the role of efficiency, convenience and productivity in influencing users' acceptance of technology (Davis, 1989; Venkatesh et al., 2003). However, concerns over Perceived Risks (PR) such as security, system reliability and data privacy can undermine users' trust of MFS (Saxena et al., 2020; Simatele & Mbedzi, 2021). In turn, this experience may impair both the quality perceptions and usage of MFS, thus highlighting the need for risk mitigation in DFI initiatives (Mutahar et al., 2022).

In Tanzania, despite ongoing security challenges (Pallangyo, 2022), Mobile Network Operators (MNOs) have implemented security measures, such as encryption and multi-factor authentication while the Bank of Tanzania (BOT) has established regulatory frameworks for consumer protection (BOT, 2023, 2020; AFI, 2020; Kameja, 2023; Di Castri & Gidvani, 2014). However, research on how PR influences MFS usage and DFI strategies remains limited. For example, Lema (2017) examined PR in MFS adoption but focused solely on direct relationships, overlooking PR's potential interactive effects, such as its moderating role on constructs like PU in influencing DFI outcomes. Drawing on Mental Accounting Theory (MAT), PR is seen as multifaceted, influencing consumer decisions in varied ways, depending on the context (Thaler, 1985, 1999). This study sought to explore these dynamics further. MAT suggests that individuals assess risks differently based on context, significantly shaping their behaviour. Findings from other regions are mixed. Some studies report that PR strongly deters MFS adoption (Mutahar et al., 2022; Farah et al., 2018) while others find that PR has minimal impact (Mha, 2015; Tobbin & Kuwornu, 2011). These inconsistencies highlight the need to examine PR's role in shaping MFS usage and DFI in Tanzania, where socio-economic and regulatory factors may create unique dynamics.

Besides, contextual factors, such as regulatory environments and technological infrastructure may contribute to these differences. For example, robust oversight may enhance user confidence while weaker regulations may heighten PR (WB, 2019). In regions with better connectivity, users perceive lower risks and higher usefulness of MFS whereas in areas with limited infrastructure, concerns over reliability and security persist (Aker & Mbiti, 2010). Socio-cultural factors, including collectivist versus individualistic orientations can also influence risk perceptions and trust in MFS (Bagadia & Bansal, 2016).

Therefore, this study sought to examine the DFI in the context of Tanzania, taking into account the interplay between PR and PU. The analysis focused on the direct relationships between PR and PU and the response variable (DFI) as well as the moderating role of PR on the PU-DFI relationship.

Theoretical Literature Review
This section reviews theoretical perspectives on DFI, low-income individuals and the core constructs (PU and PR) derived from the Technology Acceptance Model (TAM) and Mental Accounting Theory (MAT).

Digital Financial Inclusion through Quality and Usage of MFS
Digital Financial Inclusion (DFI) refers to extending formal financial services to underserved populations via digital platforms like MFS. It emphasizes access, usage and quality. This study focused on the latter two dimensions to establish user experiences with MFS (Barajas et al., 2020; Demirgüç-Kunt et al., 2018). Usage captures the extent or density of MFS usage while quality evaluates service effectiveness and user satisfaction (Cámara & Tuesta, 2014; WB, 2021). This dual emphasis highlights how MFS can facilitate secure, efficient financial management, reflecting the broader goals of DFI (Shylaja & Prasad, 2018).

Low-Income Individuals and DFI
Low–income individuals are economically vulnerable and often excluded from formal financial systems due to limited resources, limited financial literacy and geographic constraints (Banerjee & Duflo, 2011; Mogaji et al., 2021). Many rely on informal sectors and lack access to collateral required by traditional banking, making microfinance interventions crucial for financial inclusion. In this study, a multidimensional approach defines low-income individuals, emphasizing their socio -economic challenges and the potential of MFS to bridge financial gaps (Cull et al., 2009; Salecker et al.,

2020). Understanding their demographic features is necessary for convenience and proper identification of study participants, hence achieving well the study objectives.

Perceived Usefulness through the Lens of Technology Acceptance Model

The Technology Acceptance Model (TAM), originally proposed by Davis (1989) and grounded in the Theory of Reasoned Action (TRA) by Ajzen and Fishbein (1980), offers a framework to explain and predict technology adoption. TAM highlights two primary constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU refers to the extent to which a user believes that a specific technology enhances their job performance or daily activities while PEOU reflects the user's perception of the effort required to use the technology. These constructs shape the user's intention to adopt technology, which in turn predicts their actual usage behavior (Davis, 1989; Venkatesh et al., 2003).

In this study, TAM is crucial for analyzing how PU drives the adoption of Mobile Financial Services (MFS), pivotal for advancing DFI among low-income individuals in developing countries like Tanzania. MFS enables users to access and use financial services, making it a transformative tool for financial inclusion in developing contexts (Njele & Phiri, 2023). Moreover, TAM's flexibility allows the incorporation of additional constructs, such as PR, considered as significantly influencing MFS adoption. Prior studies, such as Lema (2017), emphasized that extending TAM to include PR offers deeper insights into technology adoption in financial contexts.

This study extends TAM by examining PR's moderating role in the PU–DFI relationship. While TAM highlights rational factors like PU and acknowledges the influence of external variables, such as risks (Davis, 1989), it overlooks the psychology of risk perceptions in financial management. To address this, MAT is integrated, providing insights into how PR shapes financial decision-making and DFI experiences among low-income MFS users.

Perceived Risks Explained by Mental Accounting Theory

Mental Accounting Theory (MAT), introduced by Thaler (1985) and expanded in subsequent works (such as Thaler, 1999), provides a behavioral framework for understanding financial decision–

making. It explains how individuals create subjective categorizations of their financial resources, referred to as "mental accounts," which shape their perception of risks, gains and losses and influences how they evaluate, allocate and track their finances.

A notable contribution of MAT lies in its explanation of how individuals perceive and tolerate risks in the face of financial uncertainty (Martin & Davari, 2018). By segmenting financial decisions into mental accounts, individuals weigh potential outcomes, balancing perceived utility and associated risks. Martin and Davari (2018), Nuriyev and Azizov (2019) and Sukamulja et al. (2019) highlighted that mental processes often result in varying levels of risk engagement, shaped by personal and contextual factors. For low-income populations, MAT is particularly relevant, as it offers insights into how such individuals, despite facing heightened financial vulnerabilities, may exhibit different levels of risk tolerance–sometimes embracing uncertainty to achieve financial benefits.

In this study, MAT is particularly useful for explaining why some individuals may persist in using technological advances despite PR. It provides valuable insights into how financial security perceptions and risk evaluations influence decision-making, making it central to understanding the PR's role in DFI. By revealing how users conceptualize and evaluate risks within their mental accounts, MAT enriches our understanding of behaviors, such as the adoption or avoidance of DFI initiatives. Additionally, MAT complements TAM by addressing the psychological dimensions of PR and financial decision-making issues, which TAM does not explicitly prioritize. While TAM highlights PU as a key driver of technology adoption, MAT provide possible explanations associated with cognitive and emotional processes that shape financial behavior, particularly in scenarios involving risk.

Together, these theories provide a comprehensive framework for examining the interplay of utility, risk perception and financial inclusion, offering nuanced insights into the behavioral factors influencing MFS adoption among low-income populations.

Empirical Literature Review

This section reviews existing empirical studies related to Perceived Usefulness (PU), Perceived Risk (PR), and Digital Financial Inclusion (DFI). It highlights their relationships, explores prior findings across various socio-economic contexts and

identifies research gaps to support the study's hypotheses.

Perceived Usefulness of MFS and DFI

Empirical studies widely emphasize the impact of PU on FinTech adoption, with trends varying across regions. In Denmark, Augsburg and Hedman (2014) linked mobile payment adoption to PU while Batkovic and Batkovic (2015) and Wessels and Drennan (2010) reported similar findings for mobile retail and banking services in Sweden and Australia, respectively. During the COVID-19 pandemic in Palestine, Eneizan et al. (2022) highlighted PU as a critical driver of mobile banking usage.

In Sub-Saharan Africa, Cullen and Kabanda (2018) in South Africa and Lema (2017) and Abdinoor and Mbamba (2017) in Tanzania, confirmed PU's significant role in advancing financial inclusion via mobile commerce and financial services. However, findings from regions like Malaysia and Spain suggest that PU may have limited influence under certain conditions (Shanmugam et al., 2014; Munoz-Leiva et al., 2017). Therefore, the following hypothesis was developed: *H1: Perceived usefulness of MFS influences DFI.*

Perceived Risks of MFS Directly Influencing DFI

Research on PR and DFI has produced varied outcomes. Some studies suggest that PR negatively impacts FinTech adoption in countries such as Türkiye (Akturan & Tezcan, 2012), India (Saxena et al., 2020; Chawla et al., 2023), Bangladesh (Kabir, 2013; Siddik et al., 2014) and Pakistan (Farah et al., 2018; Noreen et al., 2021). In Africa, Simatele and Mbedzi (2021) highlighted PR's role in hindering credit card payments in Zimbabwe while Abdul-

Hamid et al., (2019) observed similar challenges in Ghana.

Conversely, studies in Jordan (Mha, 2015), Ghana (Tobbin & Kuwornu, 2011) and Tanzania (Lema, 2017) found that PR had no statistical significant effect on MFS adoption and continued usage. For instance, Mha (2015) suggested that users may prioritize utility over perceived risks when service providers offer adequate assurances.

The mixed findings highlight gaps in both theoretical and empirical understanding, emphasizing the need for further studies to test hypotheses, validate findings and clarify relationships using new evidence (Kothari, 2004; Neuman, 2014). Thus, the following hypothesis was proposed: *H2: Perceived risks of MFS influence negatively DFI.*

PR Moderating PU – DFI Relationship

Moderation analysis explores factors that influence the strength or direction of relationships (Baron & Kenny, 1986; Hayes, 2013). PR, beyond its direct effects, is suggested to moderate PU's impact on FinTech adoption, as evidenced in studies from Yemen (Mutahar et al., 2022), India (Chahal et al., 2014; Kumar et al., 2023) and Bangladesh, where transaction security was highlighted as a moderating factor (Ashrafi et al., 2022).

This study builds on these studies, examining PR's moderating role in the PU–DFI relationship within Tanzania, focusing on low-income populations, using FinTech through microfinance services. This investigation led to the formulation of the following hypothesis: *H3: Perceived risks of MFS moderate the PU-DFI relationship.*
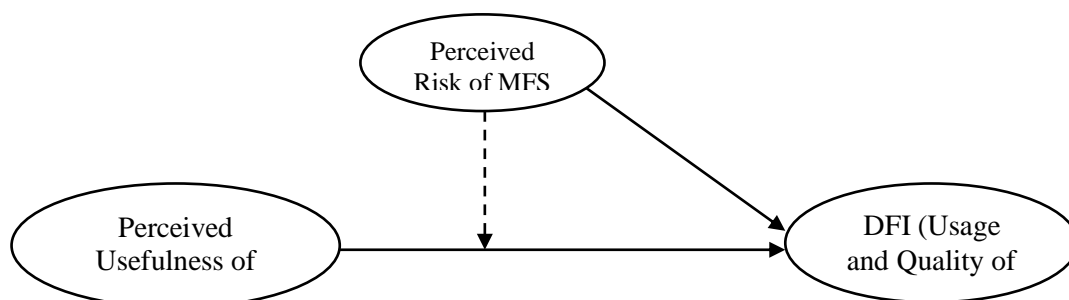

Figure 1: Study's Conceptual Framework

Conceptual Framework

In Figure 1, the conceptual framework integrates key insights from the reviewed literature and

highlights the hypothesized relationships among the study's main constructs. PU and PR act as independent variables with direct effects on DFI, represented by solid lines indicating direct

relationships. Furthermore, PR is hypothesized to moderate the relationship between PU and DFI as shown by the dashed arrow in the figure. The developed conceptual framework offers a clear theoretical structure for analyzing financial inclusion within the study's context.

Methodology

This section presents the research methodology components, including, the research design, population, sampling, research instruments and procedures for ensuring validity and reliability. It also highlights the statistical treatment of the data and reports ethical considerations.

Design

This study employed the explanatory quantitative design with the cross-sectional survey to establish relationships among key variables (PR, PU, and DFI). This approach enables the statistical analysis to uncover and explain relationships while addressing research questions through hypothesis testing (Queirós et al., 2017; Apuke, 2017; Antwi & Hamza, 2015). It was appropriate for systematically testing hypotheses, assessing relationships and determining statistical significance (Kothari, 2004). The cross-sectional nature allowed data collection at a single point in time, enabling generalization of findings to the broader low–income demographic utilizing Mobile Financial Services (MFS).

Population and Sampling

The target population comprised low-income individuals using MFS in Dar Es Salaam and Arusha regions of Tanzania. A survey was conducted with microfinance banks customers in Dar es Salaam and Arusha, , between December 2021 and January 2022 in which a total of 300 questionnaire sheets were distributed. Due to the lack of reliable data on individuals served by Microfinance Banks (MFBs), the sample size was deemed adequate based on the PLS-SEM "10-times rule", requiring at least 10 times the maximum number of indicators of any latent variable, which for this study was 160. Out of these, 283 valid responses (94.3%) were returned, indicating a high response rate. Higher response rate was bolstered by direct access to participants through Microfinance Banks (MFBs), formal introductions at survey sites and the personal administration of questionnaire sheets. These strategies enhanced the participants' understanding of the study's purpose and allowed clarification of any queries, contributing to higher response completeness and data reliability.

Instrument

As seen in Table 1, a questionnaire was developed based on reviewed literature but adapted to meet the study's specific needs. The operationalization of variables aligned with the theoretical framework.

Table 1: Operationalization of Study Variables

Constructs	Definition	Indicators	Sources
DFI through usage and quality of MFS	Extent of MFS usage by underserved populations to access financial services	Deposits and withdrawals via mobile phones Loan services (application and repayment) Balance checks through mobile apps Insurance access via mobile apps Online payments Loan tracking (repayment schedules) Accessing account statements for financial activities	WB (2021); Cámara & Tuesta (2014); Shylaja & Prasad (2018); Demirguc-Kunt et al. (2018).
Perceived Risks (PR) Associated MFS	Potential risks like financial loss, security breaches, or technical failures while using MFS.	Security Risks: Fear of hacking or unauthorized access Performance Risks: Errors like deposits to wrong accounts Financial Risks: Fear of financial losses during transactions Privacy Risks: Concerns about data breaches on mobile platforms	Mutahar et al. (2022); Almarashdeh et al. (2019); Mha (2015); El-Kasheir et al. (2009).
Perceived Usefulness (PU) of MFS	Belief that MFS improves task efficiency and financial management.	Time-Saving: Quick access to transactions and services Cost-Effectiveness: Reduced fees and travel costs Loan Management: Simplified loan applications and repayment alerts Account Information: Comprehensive access to track financial activities	Davis (1989); Venkatesh et al. (2003); Khan & Abideen (2023); El-Kasheir et al., (2009).

A structured questionnaire served as the primary data collection tool, ensuring objectivity and standardization (Aithal & Aithal, 2020; Rea & Parker, 2014). It featured closed – ended items, facilitating easy response collection and enabling advanced statistical analysis. The questionnaire comprised three main sections: Introductory section outlining the study's objectives and data collection procedures, a section capturing participants' demographic and economic characteristics and a final section addressing key study variables. These variables were broken into well-defined indicators measured using the 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Validity and Reliability
Validity and reliability were ensured at multiple stages of the study. Initially, experts in financial development and Mobile Financial Services (MFS) reviewed the research instrument, providing feedback that refined its design and ensured relevance. A pilot study involving 50 MFS users from Microfinance Banks (MFBs) was then conducted. Piloting, as highlighted by Cohen et al. (2013), helps refine questionnaire wording and enhances reliability, validity and practicability. Pilot data was tested for internal consistency, using the Cronbach's Alpha with all values exceeding the recommended 0.7 threshold, confirming good reliability (Hair et al., 2017).

Statistical Treatment of Data
Data analysis was conducted using both descriptive and inferential statistical methods to address the study's research questions. Descriptive statistics was conducted using the Statistical Package for Social Sciences (SPSS 27). Descriptive statistics was important to summarize participants' profiles and establishing data patterns on key constructs of the study (PR, PU and DFI). Interpretations were based on a 5-point Likert scale: 1.00–1.49 (Strongly Disagree/Very Low), 1.50–2.49 (Disagree/Low), 2.50–3.49 (Neutral/Moderate), 3.50–4.49 (Agree/High) and 4.50–5.00 (Strongly Agree/Very High).

Inferential Analysis was used to test the hypothesized relationships and address research questions, using the Partial Least Squares Structural Equation Modelling (PLS-SEM) as provided by the Smart-PLS 4.0.9.5 software. PLS-SEM was chosen because of its robustness, flexibility in accommodating diverse data distributions and emphasis on predictive relevance (Hair et al., 2017;

Henseler et al., 2016). Two stages of PLS-SEM evaluation were undertaken, namely measurement model and structural model evaluations. Measurement Model Evaluation assessed the reliability and convergent validity, using metrics such as Average Variance Extracted (AVE), Cronbach's Alpha and Composite Reliability (CR) while Structural Model Evaluation assessed the explanatory and predictive power of the developed model, using path coefficients, R^2 and Q^2 values. Results from these evaluations, as per standard PLS-SEM practices (Ringle et al., 2020; Hair et al., 2017), are presented in the results and discussion section.

Ethical Considerations
Ethical compliance is crucial not only in natural sciences but also in social and business research (Hosseini et al., 2022; Hunt et al., 1984). This study followed strict ethical protocols, including obtaining research clearance from the University of Dar es Salaam. Participants were fully informed about the study's purpose, data collection methods and academic use. Informed consent was obtained with guarantees of confidentiality and anonymity. Participants were required to provide honest feedback, fostering a trustworthy research environment.

Results and Discussion
This section presents, interprets and discusses the study findings in relation to the theoretical framework and empirical literature. It begins with an overview of the participants' profiles, followed by descriptive statistics for key variables and concludes with findings, addressing the study's primary questions and hypotheses.

Profile of Study Participants
The demographic and socio-economic characteristics of respondents, summarized in Table 2 (page 30), provide valuable insights into the composition of study participants.

The gender distribution was nearly balanced, with 51.9% male and 48.1% female respondents. Most participants (71.4%) were aged between 26–45 years, reflecting a predominantly economically active group. The majority (55.5%) were married, followed by single participants (29.7%). Educational attainment was generally low, with 47% completing primary education and only 15.6% achieving tertiary education or higher.

Employment data shows that 80.6% were engaged in small-scale businesses, underlining their reliance

on informal economic activities while only 6% held permanent employment. Regarding technological usage, 43.1% had used mobile phones for 5–10 years while 34.6% reported similar MFS usage durations. This indicates familiarity with digital financial tools and suggests a growing trend of MFS adoption, albeit still evolving, with relatively low usage beyond 15 years (15.9%). Furthermore, adequate usage of MFS indicates that participants had sufficient familiarity and experience with different types of MFS risks, perceived usefulness, and digital financial inclusion. These factors are important for appropriately addressing the study's key questions.

Table 2: Participants' Profile

Characteristics	Category	Frequency	Percentage
Gender	Male	147	51.9
	Female	136	48.1
Age	18-25	24	8.5
	26-35	107	37.8
	36-45	95	33.6
	46-55	50	17.6
	56-65	7	2.5
	65+	0	0
Marital Status	Married	157	55.5
	Single	84	29.7
	Divorced	27	9.5
	Widow	5	1.8
	Separated	10	3.5
Education Level	No formal education	14	4.9
	Primary	133	47
	Secondary	92	32.5
	Diploma	28	9.9
	First degree	10	3.5
	Postgraduate	6	2.2
Employment Status	Permanent	17	6
	Part-time	21	7.4
	Small Scale Business Owners	228	80.6
	Farmer	11	3.9
	Not employed	6	2.1
Duration of Mobile Phone Use	< 5	39	13.8
	5-10	122	43.1
	11-20	90	31.8
	21+	32	11.3
Duration of MFS Usage	< 5	47	16.6
	6 – 10	98	34.6
	11-15	93	32.9
	16+	45	15.9

Descriptive Statistics for Key Study Variables

This section presents descriptive results regarding Perceived Risks, Perceived Usefulness and Digital Financial Inclusion and reflected in Table 3 to 5.

Perceived Risks

The study assessed participants' perceptions of risks associated with using Mobile Financial Services (MFS). The summarized responses are presented in Table 3 (page 31). PR is associated with moderate ratings, suggesting participants exhibiting the cautious approach toward using MFS, with moderate apprehension regarding the security and accuracy of the services.

Perceived Usefulness (PU)

Participants were also asked to evaluate the perceived usefulness of MFS in streamlining their financial activities. Table 4 provides a detailed summary of their responses.

As shown in Table 4, participants reported high levels of PU for most MFS functionalities, particularly in loan repayments, saving time and providing timely alerts. However, moderate perceptions were noted for remote loan requests, suggesting potential barriers in this area.

Table 3: Perception of the Severity of Risks when Using MFS

Items	Mean	Std. Dev.	Interpretation
MFS security concerns	3.23	1.31	Moderate
Depositing into wrong accounts	3.15	1.20	Moderate
Errors in online transactions (e.g., buying insurance)	3.25	1.22	Moderate
Risk of account balance and hacking	3.20	1.25	Moderate
Financial losses during withdrawals	3.29	1.25	Moderate
Errors in online payments	3.32	1.25	Moderate
Errors in accessing account statements	3.26	1.31	Moderate

Table 4: The Extent to which MFS is Useful for Financial Activities

Items	Mean	Std. Dev.	Interpretation
MFS saves time for saving	3.66	1.19	Agree (High)
MFS is useful for saving	3.51	1.18	Agree (High)
Depositing via MFS saves time	3.76	1.14	Agree (High)
MFS is affordable/cheap for saving	3.61	1.15	Agree (High)
MFS provides wide range of account information	3.72	1.17	Agree (High)
Loan applications via MFS save time	3.71	1.11	Agree (High)
MFS are useful for borrowing money	3.62	1.20	Agree (High)
MFS speeds up loan requests and disbursements	3.71	1.18	Agree (High)
MFS allows requests and receiving of loans without visiting MFI	3.46	1.24	Neutral (Moderate)
Applying for loans via MFS supports other daily activities	3.66	1.10	Agree (High)
MFS reduces costs/cheap for applying and receiving loans	3.57	1.26	Agree (High)
MFS saves time in loan repayment	3.79	1.14	Agree (High)
MFS reduces costs in loan repayment	3.57	1.16	Agree (High)
MFS reminds users of loan repayment due dates	3.80	1.12	Agree (High)
MFS alerts users when loans are settled	3.61	1.16	Agree (High)
Loan balances are easily accessible through MFS	3.67	1.22	Agree (High)

Table 5: Levels of DFI Achieved by Users through the Usage and Quality of MFS

Items	Mean	Std. Dev.	Interpretation
MFS helped me in depositing money into my account	3.79	1.10	Agree (High)
MFS facilitated/helped in borrowing money	3.72	1.16	Agree (High)
MFS supported/helped loan repayment	3.69	1.12	Agree (High)
MFS enabled/helped in balance checking	3.79	1.09	Agree (High)
MFS helped in accessing insurance services	3.50	1.26	Agree (High)
MFS simplified/helped various online payments	3.78	1.15	Agree (High)
MFS facilitated/helped in tracking loan repayment records	3.63	1.21	Agree (High)
MFS enabled/helped accessing account statements	3.84	1.23	Agree (High)

Digital Financial Inclusion (DFI)

To assess participants' experiences with DFI, descriptive statistics on the quality and impact of MFS were analyzed. The results are presented in Table 5.

The results in Table 5 reveals a high level of DFI achieved through MFS usage. Participants expressed strong satisfaction with the functionalities provided, particularly for account management and loan-related activities.

The extent to which PR and PU influence Digital Financial Inclusion

To address the study's key questions effectively using PLS–SEM, both the measurement and structural models were looked at, following recommendations from established scholars (Ringle et al., 2020; Anderson & Gerbing, 1988; Hair et al.,

2017; Latif et al., 2020). The measurement model evaluation involved path analysis to establish factor loadings of construct indicators. Indicators with loadings ≥0.7 were deemed reliable while those scoring between 0.4 and 0.7 were retained only if their associated construct met the threshold requirements for Average Variance Extracted (AVE) and Composite Reliability (CR) set at 0.5 and 0.7, respectively (Hair et al., 2021). Items with loadings below 0.4 were excluded to enhance the model's reliability and validity.

As part of this evaluation, the following items were removed due to low factor loadings: PR (R15, R16, R20), PU (U29, U30, U31, U32, U33, U35, U37, U38, U39, U41, U43) and DFI (D45, D50, D5). These modifications resulted in the improved model, which ensured that the constructs reliably captured the intended dimensions – the modified path model as presented in Figure 1.
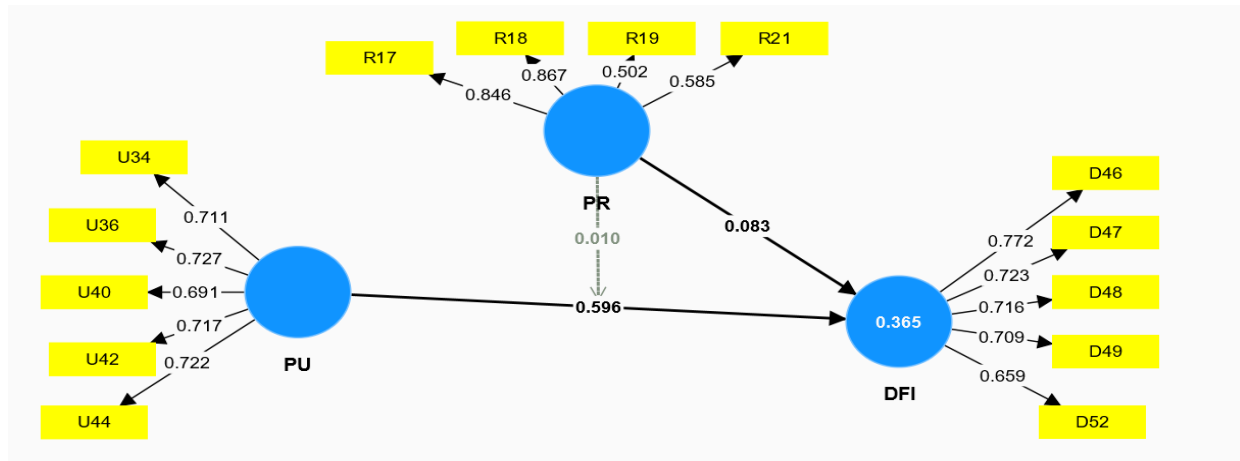

Figure 1: Adjusted Path Model

Table 6: Measurement Model Assessment

Constructs	Indicator items	Factor loadings	VIF	Cronbach's Alpha (α)	Rho_a	CR Rho_a	AVE
Digital financial inclusion	D46	0.772	1.515	0.763	0.768	0.840	0.513
	D47	0.723	1.442				
	D48	0.716	1.429				
	D49	0.709	1.525				
	D52	0.659	1.358				
Perceived risks of MFS	R17	0.846	1.423	0.751	0.770	0.802	0.515
	R18	0.867	1.477				
	R19	0.502	1.486				
	R21	0.585	1.423				
Perceived usefulness of MFS	U34	0.711	1.314	0.760	0.762	0.838	0.509
	U36	0.727	1.546				
	U40	0.691	1.440				
	U42	0.717	1.507				
	U44	0.722	1.346				

Figure 1 highlights the most significant predictors of DFI by the strength of their path coefficients: PU -> DFI (0.596); PR -> DFI (0.083) and for moderating effect PR (0.010). Based on Hair et al. (2017), these results indicate substantial, minimal and very minimal predictive power, respectively, for the outcome variable, DFI. These findings align with studies like Lema (2017), which demonstrated that while PU significantly affects MFS adoption, risk factors are less critical in developing countries like Tanzania.

In addition to factor loadings and path coefficients, internal consistency and reliability were confirmed using the Cronbach's Alpha and Composite Reliability (CR), with results exceeding the

commonly accepted threshold of 0.7. These results indicate a high level of construct internal consistency (Hair et al., 2017). Both CR and Cronbach's Alpha measured the internal consistency of a set of items, reflecting how well they collectively represent the underlying construct. Moreover, Average Variance Extracted (AVE) values greater than 0.5 confirmed that on average, the constructs explained more than half of the variance in their indicators (Latif et al., 2020). The results are summarized in Table 6.

Table 6 shows CR scores ranging from 0.802 to 0.840, which indicates high reliability while AVE values (DFI = 0.513, PR = 0.515, PU = 0.509) affirmed convergent validity.

For discriminant validity, the Fornell-Larcker criterion was employed to assess whether the study constructs are distinct and non-overlapping (Hair et al., 2021; Fornell & Larcker, 1981). This criterion ensures that each construct exhibits stronger associations with its own indicators than with those of other constructs, thereby confirming theoretical and conceptual distinctiveness. Specifically, discriminant validity is verified when the square root of the Average Variance Extracted (AVE) for each construct exceeds its inter-construct correlations. The results of this evaluation are summarized in Table 7.

Table 7: Fornell Larcker Discriminant Validity

	DFI	Perceived Risks of MFS	Perceived usefulness of MFS
Digital Financial Inclusion	0.716		
Perceived Risks of MVAS	0.111	0.718	
Perceived usefulness of MVAS	0.598	0.042	0.714

Table 8: Key Results for Predictors of Digital Financial Inclusion (DFI)

Metric	Value	Interpretation
R – Squared Value (R^2)	0.365	36.5% of the variance in DFI explained by the model (moderate)
Q – Squared Value (Q^2)	0.177	Predictive relevance (satisfactory)
Perceived Usefulness (PU)		
- Path Coefficient (PU -> DFI)	0.596	Substantial positive influence on DFI
- f^2 (Effect Size)	0.533	Substantial impact on DFI
Perceived Risk (PR)		
- Path Coefficient (PR -> DFI)	0.083	Minimal positive influence on DFI
- f^2 (Effect Size)	0.010	Minimal impact on DFI
Moderating Role of PR		
- Path Coefficient (PR x PU -> DFI)	0.010	Very minimal moderating effect on PU -> DFI

Table 9: Direct Effects of Hypothesized Relationships

Hypotheses	Model Path	β	t-values	P Values
H1	Perceived Usefulness of MFS -> Digital Financial Inclusion	0.048	12.494	0.000
H2	Perceived Risks of MFS -> Digital Financial Inclusion	0.082	1.011	0.312

The results were further analysed by testing the hypothesized relationships at the 5% significance level. For relationships to be significant, p-values should be less than 0.05 and t-values must exceed 1.96 (Hair et al., 2021). The results are summarized in Table 9.

The structural model evaluation results provided important insights regarding the influence of PR and PU on DFI. As shown in Table 8 and Table 9, PU emerged as the strongest predictor of DFI (β = 0.596, t = 12.494, p < 0.000), indicating a substantial

positive influence. Conversely, PR exhibited a minimal and statistically insignificant effect on DFI (β = 0.083, t = 1.011, p = 0.312). These findings align with previous studies, such as Lema (2017) and Mha (2015), which concluded that PR is not a critical barrier to MFS adoption among low-income populations in developing countries. This holds particularly true when the perceived utility of the service outweighs associated risks.

This outcome is also consistent with the core tenets of the Technology Acceptance Model (TAM), which

emphasizes the centrality of PU in technology adoption (Davis, 1989). Low-income individuals in Tanzania prioritize the utility of MFS for financial management and transactional convenience, thereby reflecting high PU values. The minimal positive influence of PR on DFI aligns with the Mental Accounting Theory (MAT), which posits that users acknowledge the risks associated with MFS but accept them as a necessary cost of accessing financial services. This finding supports observations by Martin and Davari (2018), suggesting resilience and adaptability among users.

Obtained results further provide the basis for confirming or refuting the hypothesized relationships, which can be summarized as follows:

| Hypothesis 1: | Perceived usefulness of MFS has a positive influence on DFI | Supported |
| Hypothesis 2: | Perceived risks of MFS influence negatively DFI | Rejected |

Table 10: Tests for Moderating Effect of PR

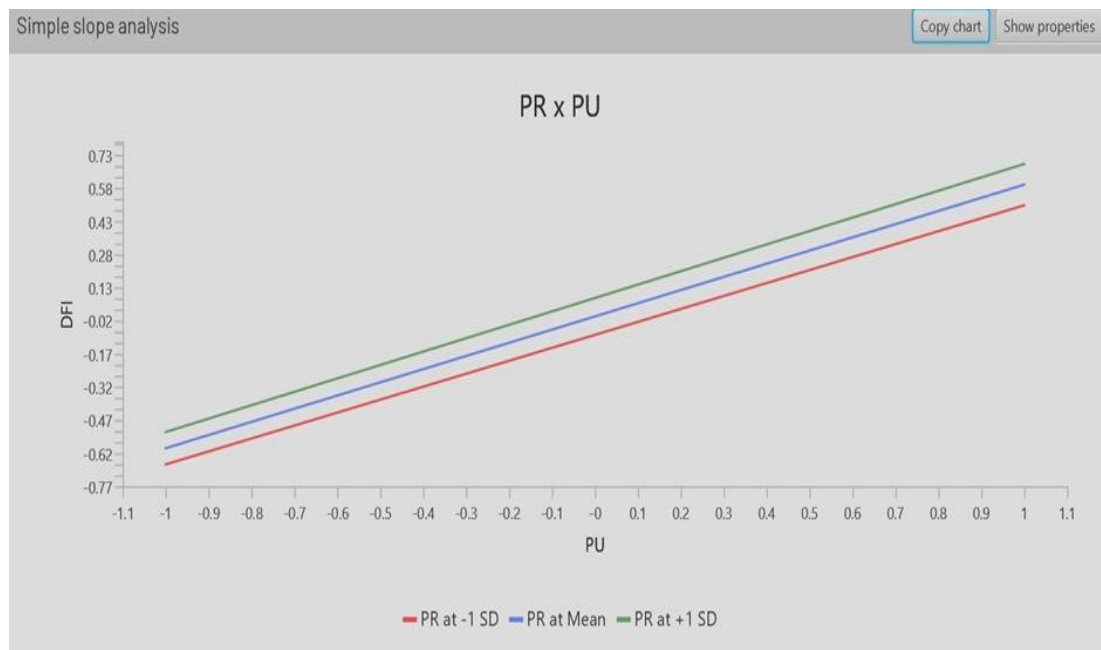| Hypothesis	Model path	t-values	P-Values
H3	PR -> PU -> DFI	0.153	0.878

Figure 2: Simple Slope Analysis of PU and DFI with PR as Moderator

The Extent to which PR Moderates the Relationship between PU and DFI

As indicated in Table 8, the moderation effect of PR was found to be very minimal (standardized β = 0.010). Further analysis through hypothesis testing confirmed this finding, using the product-of-coefficients approach with is bootstrapping as recommended by Preacher and Hayes (2008). The results are presented in Table 10.

Figure 2 depicts three parallel slopes representing the effect of PU on DFI at different levels of PR: Low (-1 SD, red line), Mean (blue line) and High (+1 SD, green line). The parallel slopes confirm that PR does not significantly influence the strength or direction of the PU → DFI relationship, as the effect of PU on DFI remains consistent across different levels of PR.

This indicates that variations in PR do not alter the positive impact of PU on DFI, demonstrating the stability and consistency of PU's effect regardless of changes in PR. This suggests that PU's positive impact on DFI remains consistent across all levels of PR.

The absence of a significant moderating effect contrasts with findings from contexts with higher consumer risk sensitivity (e.g., Mutahar et al., 2022). Probably, robust regulatory frameworks by the Bank of Tanzania (BOT) and effective risk mitigation by MFS providers may be responsible for neutralizing the PR's moderating influence. This finding also aligns with the premise of MAT (Thaler, 1985, 1999), suggesting that economic utility often outweighs risk concerns in decision-making, especially in

contexts where immediate financial needs are paramount.

Conclusion and Recommendations

The study's descriptive results show that participants exhibited moderate levels of Perceived Risk (PR) associated with MFS, indicating a cautious but engaged approach toward using these services, with particular concerns about security and accuracy. Additionally, high levels of Perceived Usefulness (PU) in MFS functionalities, especially in loan repayments and time-saving features, underscore the significant positive impact of MFS on participants' financial activities. High levels of Digital Financial Inclusion (DF) achieved through MFS usage highlight the enhanced accessibility and satisfaction with financial services among users, particularly in account management and loan-related activities.

From the hypotheses testing, the study has shown that PU of MFS is critically important in driving DFI with a substantial positive effect while PR appeared to have no direct effect on DFI nor in moderating the PU → DFI relationship. Therefore, improving MFS functionality by emphasizing various aspects of PU is critically important in developing economies like Tanzania. Based on the results of descriptive statistics, these risks, though moderate, should not be ignored. Addressing different types of risks associated with MFS usage should remain a priority for providers and regulators. For MFS providers, it is recommended to enhance the benefits of MFS according to low-income users' needs. Similarly, regulatory authorities, such as the Bank of Tanzania, should maintain their oversight and expand educational programs to build trust and confidence in MFS. Future research should explore evolving risk dynamics and technological innovations to proactively monitor and address emerging risks in the world of DFI.

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