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Enhancing financial inclusion in Pakistan: Moderation mediation roles of financial digital literacy and consumer digital protection for mobile money adaptation & usage

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Abstract

Despite the transformative potential of mobile money (MM) for financial inclusion (FI) in Pakistan, its adaptation faces challenges, particularly concerning user trust and capability. This study investigates the mediating role of Digital Consumer Protection (DCP) and the moderating role of Digital Financial Literacy (DFL) in the relationship between MM adaptation & usage and FI outcomes in Pakistan. Employing Partial Least Squares Structural Equation Modelling (PLS-SEM) on a dataset of 413 valid responses, the findings confirm that MM usage positively affects FI. Crucially, Digital Consumer Protection positively mediates this relationship, enhancing trust and mitigating risks associated with digital transactions. Furthermore, Digital Financial Literacy positively moderates the link, significantly strengthening the effectiveness of mobile money services on financial inclusion by improving user understanding and confidence. This research offers novel insights by empirically modelling the intertwined effects of DCP and DFL within the Pakistani context using the UTAUT2 framework, thereby contributing to the behavioral finance literature. Practically, the results underscore the imperative for policymakers and financial institutions to implement targeted educational programs and robust regulatory measures to foster a secure and informed digital financial ecosystem, maximizing the benefits of mobile money services for broader financial inclusion.

Keywords Digital Wallet, Digital Consumer Protection, Financial Inclusion, Digital Banking, Mobile Money, Financial Literacy.

1. Introduction

In the post-internet era, the most significant advancements remain the e-business and Internet (Heijden et al., 2006). The adaptation of mobile gadgets by consumers, & the availability of (3-G) technology, mobile commerce (MCommerce) certainly became the ultimate e-commerce (Lashitew et al., 2019). The primary explanation for mobile sector expansion at such a fast pace is

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the mobile Internet speed is a medium of communication, content business and services. High-tech improvements are revolutionizing all the fields and directions of our life we invest money in and employ smart banking technologies. Technology fusion and cellular phones have opened new opportunities and applications (Cabanillas et al. 2019). Offering Financial services bank-related by mobile means is referred to as e-banking. Most studies indicate that small to medium businesses (SMBs) make up mostly private sectors in both advanced and emerging nations. This has helped immensely in poverty alleviation and development in developing nations (Ayyagari et al., 2005).

This enterprise enables digital commercial processing through diverse payment sources such as banking cards, electronic transfers, and internet purchases using virtual payment systems, operating without physical money in a large-scale economy (Taylor, 2016). Technology-driven cashless operations are facilitated and satisfy all governmental requirements of Pakistan (Sadi & Noordin, 2011). This development represents swift market progression. Analyzing worldwide market shifts, global populations have become increasingly cash-free in their spending patterns (Kumar et al., 2021). Professional advisors, governmental leaders, organizational managers, and financial experts internationally have supported the evolution from currency-based to electronic financial markets. This business methodology appears to deliver enhanced benefits compared to cash-dependent market operations (Dahlberg et al., 2017). Digital transaction systems minimize physical currency usage while promoting electronic payment options including banking cards, online financial services, transaction terminals, mobile banking, and electronic wallet solutions (Maurer, 2019). This operational framework presents multiple advantages, with comprehensive digital technology adaptation enabling users to eliminate large cash carrying requirements, substantially reducing hazards connected to physical money management. Companies and Governments will save billions since they will not be required to incur expenses associated with cash management (Junger and Mietzner, 2020). There is still much to be done as digital payments gain momentum; It will make services and business more effective and decrease expenses. Facilities are present for businesses that don't have bank accounts; 44% of mobile phone users are wirelessly connected, but only 22% Pakistani grown-ups utilize financial assistance. Pakistan is rapidly becoming a digital-first country and is projected to be the 4th largest digital economy by 2030 (Zafar, et al., 2020). Wallet upgrades are a recent innovation with 27.3 million active users and growing 87% year on year. Several key contributors of digital wallets are Google Pay UPaisa, Easypaisa, Nayapay JazzCash, and UBL Omni; primarily used in workplace correspondence (Mahmood, et al., 2019). Free jobs even though they have some issues that can be settled, & the drawbacks can be avoided with the benefits. For instance, less privileged individuals are at risk of financial exclusion as they are unable to access these financial facilities (Bayero et al., 2015), since primarily they don't own a cell phone or other mobile technology. Also, there are individuals who do not know that these facilities exist. $1.5 million rupees Pakistan can save when citizens move towards the digital economy, Karachi leading the way (Anshari et al., 2022). Innovation has been the key driver of the monetarist rebellion, and 89% of the inhabitants is believed to turn cashless through online transaction systems. Today, merely 11% of individuals in Karachi utilize these services (Anshari et al., 2022). State Bank of Pakistan (SBP, 2022) reported that customers have made a considerable move away from cash transaction systems towards epayments. The number of services and products offered and bought online through websites like Daraz, Pakwheels, OLX, and Zameen.com are evidence of ease of digital services found by people & use of online services. Some of these websites also have digital payment options like Upaisa or Jazzcash, the preferred choice, by most people (Hossain et al.,2024). Individuals face some issues that impact their

prospects when employing electronic transactions services. The four primary issues are restricted Online platform availability, inconsistency among different services for clients, cybersecurity risk in digital transactions, and lastly the ban on offering these facilities to the public (Agarwal and Zhang, 2020).

The spread & greater use of smartphones in rural regions and rise of MM agents have fueled greater expenditure. In 2009 globally, 100 million mobile money users were there (GSMA, 2015). Numerous advanced countries show superior mobile money adaptation compared to traditional banking services. The 2023 GSMA Financial Market Overview recorded 1.6 billion registered mobile payment users globally, demonstrating a 13% rise from 2021 levels. Data suggests that mobile financial platforms are advancing more rapidly than expected (Wu, 2022). With GSMA (2023) documenting expanding user populations across diverse regions. Despite vigorous growth in developed areas, substantial markets continue progressing while developed regions experience employment limitations. Sub-Saharan Africa and India are expected to contribute nearly half of all new mobile connections worldwide between 2022 and 2030.

Financial service access enhances by activating money for most individuals who were out of reach of banks because of low balances or far distances to meet minimum deposit levels for ultimately activating an account (Kikulwe & Qaim, 2014; Suri et al., 2014). Due to mobile banking, households now remit cash from their phones exclusively by visiting the bank personally or remitting money through the mobile phones (Alshari and Lokhande, 2022). Besides their capacity to understand financial mobile amenities and literacy are closing the divide quite quickly, such as billions of individuals who are unbanked today have access to cell phones and are succeeding in booming marketplaces (Katakam, 2019). Most prominently, mobile users' statistics within the country rose by 19% year to 867m (Metri & Rana, 2020).

Gupta (2004) additionally posited that mobile banking allows for saving and receiving money by households but for its universal adaptation face challenges in the form of communication issues, competition, connectiveness, and digital literacy. The implementation of sophisticated mobile financial services transcends technological innovation, encompassing a broader socio-economic transformation with the power to redesign monetary structures and enhance economic inclusion for marginalized groups. Etim (2014) asserted the significance of mobile money in allowing individuals to save money effectively and un-interrupted financial admittance services, opening the door to further diversifying and individuals' financial enablement.

To comprehensively understand the intricate factors influencing mobile money adaptation and its impact on financial inclusion, particularly the roles of digital consumer protection and digital financial literacy, this study is theoretically grounded in the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). This robust framework provides a lens through which to examine user behavioral intentions and technology adaptation in consumer contexts. A detailed exposition of UTAUT2 and its application to the study's hypotheses will be presented in the 'Theoretical Framework' section.

Despite the promising advancements and widespread mobile penetration, the full potential of mobile money services in driving comprehensive financial inclusion in Pakistan remains underexplored, particularly concerning the factors that underpin sustained user adaptation and trust. While extensive research has examined the direct impact of mobile money on financial inclusion, there remains a significant gap in understanding the intertwined and synergistic roles of Digital Financial Literacy (DFL) and Digital Consumer Protection (DCP). Existing studies often treat these critical factors in isolation, overlooking their combined influence on user perceptions

of security, usability, and, consequently, their willingness to adopt and continue using mobile money services.

Moreover, the specific socio-economic challenges and regulatory environment of Pakistan present a unique context that has not been adequately explored in the existing literature. Studies focusing on developed economies, or even other developing countries, cannot fully capture the complexities and barriers faced by the Pakistani population, where factors like information asymmetry and limited awareness persist. This research aims to address these critical gaps by providing a nuanced analysis of the interplay between DFL, DCP, and mobile money adaptation, specifically within Pakistan, to shed light on how these factors jointly influence financial inclusion outcomes.

This research applies UTAUT2 theory to examine research gaps. Combining these views brings about improvement by analyzing the impact of Tech receptiveness, market access capability, perceived value, and new expansion. This integrated view offers thorough technology-influencing features familiarity as well as usage patterns, aiding businesses as well as policymakers in taking well-versed decisions. Furthermore, through quantitative modeling and emphasizing Pakistan's distinctive socioeconomic, our research was able to offer actionable insights throughout setting to inform governing bodies, financial entities, & educators to develop a harmonious digital marketplace. This research work enriches scholarly discussion and produces favorable impacts through enhanced financial awareness initiatives, reinforced consumer protection strategies, and promoted mobile technological solutions that advance digital equity and stimulate economic progress.

This study significantly contributes to existing literature both theoretically and practically. First, it demonstrates the interconnected dynamics between mobile technology benefits, consumer behavior changes, digital consumer protection (DCP), digital financial literacy (DFL), and financial inclusion outcomes. A primary theoretical advancement is positioning DCP as a mediator between mobile money adaptation and financial inclusion achievements. This necessitates modifications within existing fintech theoretical frameworks to properly acknowledge consumer digital protection as a fundamental path to financial digital inclusion. Secondary, the research establishes that perceived security, trust, and information accessibility are critical determinants influencing individual decisions to embrace fintech solutions. By highlighting the protective functions of digital consumer safeguards and digital financial literacy, this study demonstrates how policy interventions and regulatory frameworks can amplify fintech's contribution to financial inclusion efforts. These findings challenge existing theoretical assumptions about fintech utilization by emphasizing the necessity of incorporating regulatory support for digital consumer protection within fintech ecosystems. Overall, this study provides a foundation for future research to refine methodological approaches and better understand the multifaceted nature of fintech-enabled financial inclusion.

Thirdly, for practical implications, this paper yields important inferences for policymakers, financial institutions, and fintech service providers across multiple dimensions. Primarily, fintech companies must prioritize establishing user trust through transparent communication practices, robust security measures, and comprehensive customer support systems. Strategic investments in user interface enhancements, system performance optimization, and service reliability improvements are essential for service quality advancement and customer retention. Fourthly, Given the critical importance of security in today's digital landscape, companies should implement

regular information security updates while providing ongoing user education to address safety concerns and strengthen trust relationships. Additionally, both policymakers and institutions should collaborate to enhance digital financial literacy across populations. Fintech providers can contribute by integrating educational resources and guidance materials into their platforms through innovative and engaging delivery methods. Policymakers play a vital role in establishing transparent regulatory frameworks and clear procedural guidelines, which can foster greater trust while encouraging fintech innovation that addresses diverse financial requests. Targeted ingenuities to improve digital financial literacy, particularly among underserved populations, represent transformative opportunities for financial inclusion. Finally, sustained association amongst fintech firms, policymakers, & regulatory bodies is crucial for the continued evolution of fintech platforms. Implementing systematic evaluations of user experience, security protocols, and digital service performance will ensure the maintenance of positive outcomes and support the robust development of computational finance solutions.

2. Literature and Hypothesis

Mobile phone money services mean admittance and withdraw financial amenities that were once administered by financial conventional institutes (Grzybowski & Mothobi, 2017). The amenities offer a space for money transfers & payments. Mobile banking/ money is likewise known as "mobile banking and branchless banking" (Birochi et al. 2011). Earlier days saw conventional banks & automatic banking services like ATMs and electronic banking failing to address the wants of customers. Although new technology has enhanced access to and availability of these services, Net connectedness has also enabled the propagation of cellphone monetary services.

The 2023 Digital Census indicates Pakistan's population at approximately 240 million residents. Mobile devices enjoy widespread adaptation throughout the Pakistani market. Critical aspects of digital utilization and consumption behaviors in Pakistan during the first quarter of 2024 are detailed as follows:

- 111.01m of Pakistani population is availing internet, and penetration rate of the internet is 45.71% as of early 2025.
- As of February 2024, Pakistan had 71.71 million users of social apps, representing 29.5% of the entire population.
- Since the beginning of 2024, Pakistan's total mobile phone connections stand at 188.9 million, which equates to 77.8%.
- 40% of the total is Pakistan's population (World Bank, 2024). Of the total of around 96.8 million not having a bank account, 63% are rural residents (World Bank, 2024).

Currently ten network operators in offer diverse mobile money services in Pakistan, including Sadapay, Nayapay, JazzCash, Easypaisa, and UBL-Omni. Initially, the State Bank of Pakistan introduced the non-bank regulations in 2008 licensed only banks. Now, mobile banking is facilitated by various corporations partnering with mobile operators (CGAP, 2014). Bakr (2019) highlights digital cash transfer technology as essential for achieving universal financial access. Key Monetary conversion services, specifically for individuals who work in the informal economy, like small, medium businesses. Jussila (2014) pointed out financial service providers and mobile phone users are closing the gap in access by mobile money transfers, particularly the unbanked who run small dealings in developing nations. Rangarajan (2008) indicated that low-

cost transactions by usurp technology such as mobile phone money will open the spreading of such services to remote locations. Accordingly, based on the indication, this research presents the subsequent premise:

H1: *Mobile money usage and adaptation positively affects financial inclusion.*

Digital consumer protection (DCP) is increasingly recognized as a critical component for fostering trust and encouraging the adaptation of digital financial services, thereby enhancing financial inclusion Malady (2016). As mobile money (MM) services expand, the potential for cyber threats and data privacy concerns also rises Njoroge (2016), and Mugambi (2017). Strong DCP measures are essential to mitigate these risks, ensuring that consumers receive accurate information, are treated fairly, and are protected from fraudulent activities (Senyo et al., 2019). This proactive approach builds confidence among potential users, reducing their apprehension towards digital transactions and encouraging greater engagement with mobile money platforms.

From a theoretical perspective, robust DCP can be conceptualized as a crucial 'Facilitating Condition' within the UTAUT2 framework, as it provides the necessary infrastructure and safeguards that enable users to confidently adopt and utilize mobile money services. Rowan & Mazer (2016) says that when users perceive that their financial transactions and data are secure, and that effective redress mechanisms are in place, their willingness to engage with MM increases, which in turn strengthens the pathway to financial inclusion. This aligns with prior research emphasizing perceived security and trust as vital determinants of continuous intention to use mobile financial services. Therefore, by fostering a secure and trustworthy environment, DCP acts as a crucial intermediary, translating the availability of mobile money services into tangible financial inclusion outcomes (Nyati et al., 2020).

Based on CGAP's 2018 findings, safeguarding consumers represents a fundamental component of inclusive finance, ensuring that existing financial service users receive fair and adequate benefits within the marketplace. This protection framework enhances public trust in financial institutions and strengthens their credibility among prospective clients. Caruana (2017) argues that the prevalent adaptation, such as mobile payment systems, has intensified both the frequency and scale of digital security breaches, creating significant risks to user data protection and personal privacy for mobile device users.

H2. *Digital consumer protection positively mediates the linkage between mobile money adaptation & usage and financial inclusion.*

Digital financial literacy (DFL) is a four-dimension notion that involves knowledge financial internet-based products and services, knowledge of digital risks and management techniques, consumer rights and redressals' (Morgan et al., 2019). Also, Park (2011) outlines three dimensions of digital literacy as it applies to online financial behavior: technical comfort in using the internet, institutional awareness of practices, and familiarity with privacy policies. Within the purview of this research, DFL is being suggested as a moderator that affects the magnitude of the relation among integration of MM usage and financial inclusion (FI) in Pakistan.

DFL moderates the impact of MMA use on FI by improving people's capacity to use mobile money services efficiently, thus intensifying integration on financial inclusion. In the UTAUT2 model of Venkatesh (2012), DFL corresponds with expectancy efforts', or ease of using a technology as perceived. Increased levels of DFL decrease the perceived difficulty of mobile money platforms, making it easier for users taking advants of services such as savings, transfers,

and access to credit Hogarth, (2003). For example, individuals with high DFL are more capable of using mobile money apps, being able to comprehend transaction procedures, and avoiding errors like fraud, thus strengthening the connection between MMA usage and FI.

Moreover, DFL supports performance expectancy by increasing users' confidence in achieving financial goals through mobile money, such as improved savings or access to credit. In Pakistan, where only 35.3% of adults use mobile money (World Bank, 2021), low DFL can weaken the impact of MMA usage on FI, as users may struggle with digital interfaces or lack awareness of available services. On the other hand, strong DFL equips the ability to maximize full potential of mobile money, improving the extent of financial inclusion, especially for underserved groups (Künt et al., 2022). The advantages of DFL as a moderator are, DFL allows users to make smart decisions regarding mobile money products, choosing the appropriate goods that suit their financial requirements (e.g., savings or investment services), thereby strengthening the link between MMA usage and FI (OECD, 2021). Awareness of digital financial risks, including hacking or phishing, and risk management measures builds users' confidence in mobile money platforms, eliminating adaptation barriers and enhancing FI (Ozili et al., 2018). DFL promotes trust in digital transactions, making users embrace mobile money for basic financial services, which is conducive to Pakistan's shift to a cashless economy and fosters FI (Anshari, 2022). In Pakistan's online financial environment, DFL plays a pivotal role because of issues such as poor literacy levels and scarce digital service awareness (Bayero, 2015). DFL acts as a mediator between the MM–FI relationship in the sense that it fills the gap, especially for low-income and rural dwellers who use mobile money to access formal financial services (GSMA, 2023). For instance, those with higher DFL are most likely to utilize mobile money optimally in transferring remittances or bills, hence more financially inclusive (Panos & Wilson, 2020; Kumar et al., 2023). On the other hand, if the DFL is minimal, then the positive impact of mobile money adaptation may be reduced as users would not fully utilize the services due to the lack of skills or fear of fraud (Surisetti & Khan, 2021). According to the literature and UTAUT2 framework, we posit that DFL reinforces the relationship between MMA utilization and FI by increasing users' competence and confidence in digital financial platforms.

H3*: Digital financial' literacy positively moderates the linkage between mobile money adaptation-usage and financial inclusion outcomes enhancing the effectiveness of financial mobile services.*

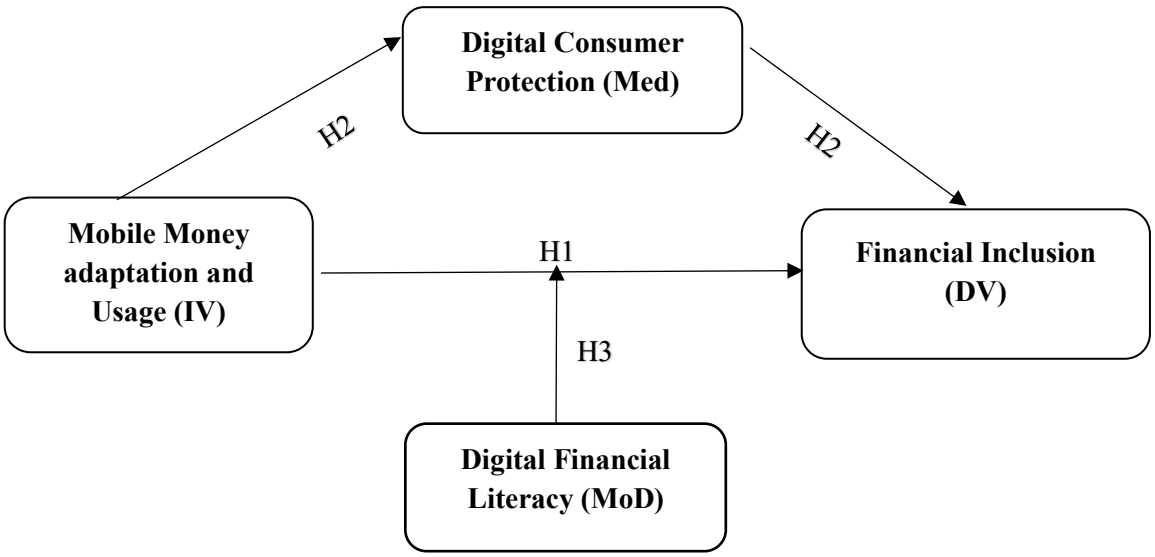
3. Framework & Schematic (Theoretical diagram)

The Theory of Acceptance (UTAUT) model has been widely used in technology adaptation research since its inception in 2005. Adaptation/Integration is impacted by designated values that individuals hold when operating technology. Effort expectancy and performance expectancy are core motivations prompting users to embrace technology. From an economic viewpoint, these factors reflect the leading influences on users' economic effectiveness in assessing novel technical solutions. Several new antecedents from the advent of UTAUT2 motivated users to use technology, including hedonic values, habits, and perceptions of price value, concentrating more on customer loyalty and quality of life (Xu et al., 2015). Technology achieves success by addressing varied customer demands, though exceptional technology distinguishes itself by delivering greater value to meet user expectations. The UTAUT model illuminates how people develop selection preferences for certain offerings through their assessment of perceived benefits against associated costs. Decision-making processes reveal usage patterns from the subjectivity of the users to perceived benefits and sacrifices in using the service (Omigie et al., 2017). M-payment adaptation

is viewed as a new payment medium that provides benefits or rewards for its users. This theory posits that consumers are active technology users and rely on certain values as drivers of continuance intention (Xu et al., 2016).

This study aligns Venkatesh (2012), who emphasizes that innovation adaptation is primarily influenced by customers' internal evaluations of redesigned features rather than external observers' perceptions. Among the five attributes identified in his model relative complexity, benefit, trialability, compatibility, & observability. These dimensions are central to Rogers' diffusion model which are empirically validated as a strong predictor of innovation (Klein & Tornatzky, 1982).

This framework, constructed following an exhaustive literature review and supported by the (UTAUT-2), comprises three conceptual phases. The first phase analyzes the direct correlation between the independent variable (implementation & use of mobile banking) and the dependent variable (financial inclusion). The second stage includes tech-based consumer protection as a moderator, enabling the impact of mobile money adaptation & use on financial inclusion. The 3rd stage studies digital financial literacy as a moderator, enhancing the interaction among mobile money adaptation & utilization & financial inclusion.



This model encompasses four hypotheses: one direct hypothesis mobile money/mobile banking usage and integration impacts financial inclusion; an indirect hypothesis consumer digital protection mediates the impact the use of mobile banking and integration on financial inclusion; and one moderation hypothesis financial digital literacy moderates the impact of mobile money usage & adaptation on financial inclusion' in that the impact is more pronounced with increasing levels of financial digital literacy. These relationships are shown in Figure I, which demonstrates the direct, mediated, and moderated paths.

4. Methodology

4.1. Data Collection

This research employs survey and test techniques to release opinion poll to gather quantitative information, analysis of data to address developed objective to be met and hypothesis testing the data gathered from people as the unit of analysis since this research aimed at all

workers serving at least managing level in public and cloistered sector, in this sector participants range from supervisory position to director level while the public sector focused on officers at BPS 16 and higher grades these people possess suitable income level and education qualification necessary to recognize and utilize mobile based technology application for financial and banking transactions such specific socioeconomic features defined the research unit of analysis (Sekran, 2021). Recognizing the vast target population of mobile money users in Pakistan, which includes approximately 61.3 million m-wallet holders as reported in The Nation newspaper on January 31, 2025, with JazzCash alone accounting for 48 million m-wallet accounts and 18 million active users, a sampling approach was necessary. Given the impossibility of surveying the entire population, a representative sample was selected. Using Qualtrics software, a minimum sample size of 385 was determined to be adequate for analysis at a confidence level of 95% and a 5% margin of error. This estimation is further supported by Tatham (2006), who suggests that a sample size of 300 is generally sufficient for performing robust Partial Least Squares Structural Equation Modelling (PLS-SEM).

For data collection, we contacted private and public sector officials in key urban centers: Lahore, Peshawar, Islamabad, and Rawalpindi. These cities were chosen due to their status as capitals and major business hubs, encompassing diverse urban populations with varied socio-economic backgrounds, thereby enhancing the generalizability of the findings within these prominent regions of Pakistan.

4.2. Estimation technique

In this research the analysis of data was conducted using PLS SEM. This statistical approach was scheduled selected due to its numerous advantages (Hair, 2011; Kock, 2014) initially PSM proves suitable for model containing latent ideas that directly cannot be observed while accounting for measurement errors additionally SEM analysis accommodates simultaneous examination like those employed in the in this research furthermore PLS and effectively estimated and these models when working with smaller sample size variance based Sam was implemented since this research represents an exploratory extension of existing theoretical frameworks this study introduced novel conceptual perspective from a theoretical standpoint moreover various bases and offers advantage by avoiding the reliance on multiple assumptions such as the requirement for complete data sets or specific distributional properties.

PLS based data analysis does not necessitate normal distribution assumptions since non-normality is presumed. The method accommodates various data types, including nominal categorical, ordinarily ratio and interval measurements. This research employed an intervals scale measurement through a 5-point Likert scale format capturing participants' replies ranging strongly disagree to agree with presented statements.

5. Empirical Analysis

The findings are derived from 413 valid samples of responses from a distributed 779-questionnaire (representing a 53 % response rate). This section summarizes the measurement model testing together with the analysis of reliability. Convergence & discrimination validity s included in this section as well. The following section presents the structural model analysis, mediation effects examination, and research findings.

The model measurement illustrates the association of constructs and their equivalent

variables indicators. This study employs a thoughtful model measurement designed to ensure the precision and dependability of construct/concept measurements. Consequently, the measurement model development involves sequential examination and validation of three essential components: reliability, convergence and discriminant validity.

Table I: Reliability and Validity Analysis

Outer Loadings

	FI	CP	DFL	MM	DFL x MM
FI.1	0.876				
FI.2	0.864				
FI.3	0.833				
FI.4	0.871				
DCP.1		0.758			
DCP.2		0.773			
DCP.3		0.837			
DCP.4		0.858			
DCP.5		0.826			
DCP.6		0.776			
DFL.1			0.844		
DFL.2			0.846		
DFL.3			0.886		
DFL.4			0.858		
DFL.5			0.868		
DFL.6			0.798		
MM.1				0.852	
MM.2				0.796	
MM.3				0.805	
MM.4				0.840	
MM.5				0.808	
MM.6				0.815	
DFL x MM					1.000

Composition reliability (*rho_c*)			
0.920	0.917	0.940	0.925
Alpha-Cronbach			
0.884	0.891	0.923	0.902
Average Variance Extracted - AVE			
0.742	0.649	0.724	0.672
Composition reliability (*rho_a*)			
0.888	0.894	0.924	0.906

Variance extraction (*AVE)* values for all variables are displayed in Table II. As Table II shows, all models' fit and quality index results are excellent, complying with all the requirements to continue the analysis.

Table II: Convergence validity test

Indicators	VIF'
FI-1	2.432
FI-2	2.226
FI-3	2.084
FI-4	2.513
DCP-1	1.741
DCP-2	2.333
DCP-3	2.500
DCP-4	2.860
DCP-5	2.546
DCP-6	2.356
DFL-1	2.696
DFL-2	2.565
DFL-3	4.234
DFL-4	2.866
DFL-5	3.424
DFL-6	2.599
MM-1	2.489
MM-2	2.097
MM-3	2.185
MM-4	2.582
MM-5	2.337
MM-6	2.288
DFL x MM	1.000

	Average Variance	Collinearity Statistics
Constructs	**Extracted (AVE)**	**VIF**
FI	0.742	2.314
DCP	0.649	2.389
DFL	0.724	3.064
MM	0.672	2.330

From Table III, the criterion of Fornell & Larcker's result shows that all the values are in a good range, which proves discriminant validity in the model.

Table III: Criterion Fornell & Larcker

	DCP	DFL	FI	MM
DCP	0.806			
DFL	0.839	0.851		
FI	0.859	0.860	0.861	
MM	0.851	0.874	0.871	0.820

Construct	Square Root of AVE	Highest Correlation
DFI	0.742	0.860 (with DFL)
DCP	0.649	0.851 (with MM)
DFL	0.724	0.839 (with DCP)
MM	0.672	0.874 (with DFL)

Table IV shows the cross-loadings for all variables examined in this paper, demonstrating detailed associations between individual items and their respective latent constructs.

Table IV: Cross Loadings

	FI	DCP	DFL	MM	DFL x MM
FI1	**0.876**	0.795	0.806	0.734	0.174
FI2	**0.864**	0.778	0.776	0.852	0.193
FI3	**0.833**	0.694	0.663	0.716	0.024
FI4	**0.871**	0.684	0.702	0.687	0.030
DCP1	0.678	**0.758**	0.716	0.619	0.056
DCP2	0.568	**0.773**	0.647	0.615	0.003
DCP3	0.781	**0.837**	0.712	0.779	0.138
DCP4	0.775	**0.858**	0.732	0.725	0.156
DCP5	0.679	**0.826**	0.721	0.689	0.056
DCP6	0.551	**0.776**	0.618	0.675	0.104
DFL1	0.740	0.691	**0.844**	0.705	0.030
DFL2	0.776	0.744	**0.846**	0.765	0.084
DFL3	0.759	0.731	**0.886**	0.779	0.206
DFL4	0.720	0.779	**0.858**	0.722	0.187
DFL5	0.632	0.718	**0.868**	0.763	0.181
DFL6	0.653	0.717	**0.798**	0.723	0.150
MM1	0.793	0.767	0.811	**0.852**	0.091
MM2	0.671	0.643	0.653	**0.796**	0.142
MM3	0.756	0.707	0.683	**0.805**	0.247
MM4	0.696	0.784	0.752	**0.840**	0.180
MM5	0.602	0.712	0.692	**0.808**	0.178
MM6	0.648	0.674	0.678	**0.815**	0.090
DFL x MM	0.108	0.154	0.128	0.187	1.000

All the HTMTs in Table V are presented beneath, which are less than the threshold of *0.9* and *1*.

Table: V: HTMT Ratio

	DCP	DFL	FI	MM	DFL' x MM
DCP					
DFL	0.788				
FI	0.818	0.824			
MM	0.836	0.755	0.849		
DFL x MM	0.113	0.171	0.13	0.198	

5.1. Structural Model

The PLS-SEM method and bootstrapping technique use path coefficients and *pvalues* or *tvalues* for the significance of correlation structures (Hair et al., 2018). Model structure evaluation determines whether the theoretical framework predicts the expected relationships. This research utilized significance values, coefficient (R^2), & effect size (f^2) to evaluate the model's structural performance. Hypothesis testing employed a two-stage approach. Initially, this research observed the direct connection between mobile money integration & usage on digital financial inclusion. Subsequently, upon establishing significant direct effects, a second analysis was conducted to validate the mediator role of tech-based consumer protection & digitized financial literacy in the connection between mobile money adaptation and financial digital inclusion.

5.2. Testing Hypothesis / Direct Relationships

Figure 1 provides a visual representation of the path coefficients and direct impacts along with their significance levels, which are also detailed in Table 4.6.

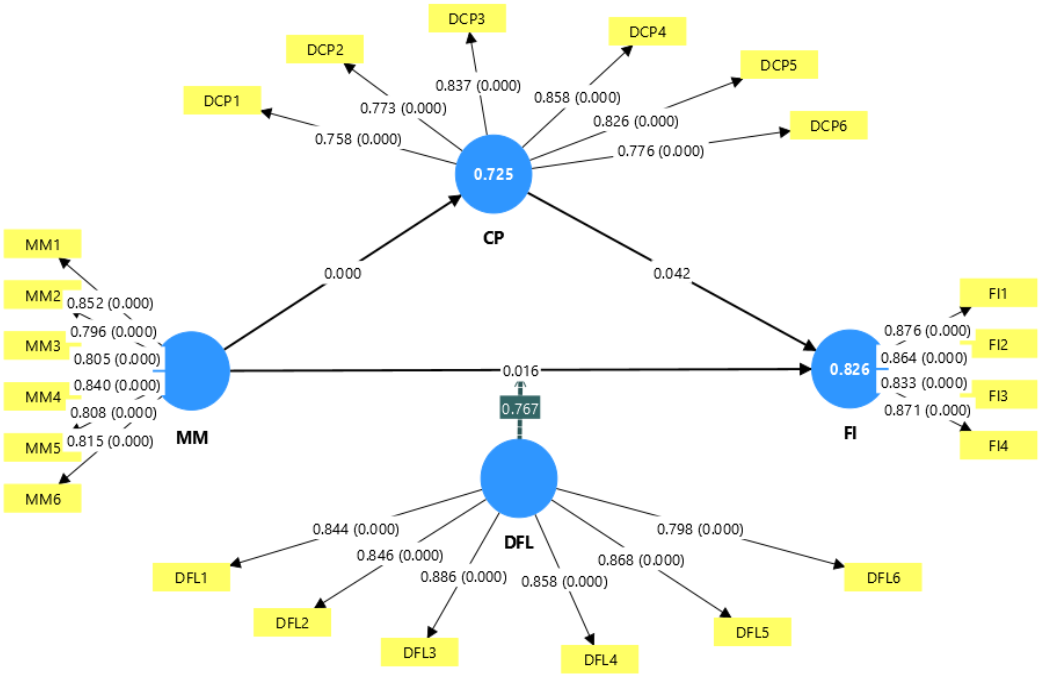


Figure 1: Visual representation of the path coefficients

Table VI: Path coefficients - Independent Variable direct effects on Dependent Variable.

5.3. Co-efficient (β) and (t)values

Bootstrapping technique enabled the assessment of path coefficients', *p-values* and *t-values*, According to Hair et al. (2017), a minimum sample size of 5000 is considered appropriate for bootstrapping procedures. Path coefficients demonstrate the direct influence of predictor variables on outcome variables through the coefficient approach. Given that path coefficients derive from correlation analysis, they represent standardised values. The Beta coefficient indicates the degree to which changes in independent variables consequences the dependent variable on financial

inclusion. These calculations were performed using SmartPLS's bootstrap feature across 5000 samples. The model's statistical values are presented in the table below.

Table VII: Hypothesis Testing

	Hypothesis	B	*t-value*	*P*	Decision
H1	MM ⟶ FI	0.045	4.305	0.016	Accepted
H2	MM ⟶ DCP ⟶ FI	0.087	2.656	0.041	Accepted
H3	MM ⟶ FI FL	0.145	8.905	0.019	Accepted

HI: Mobile money adaptation & usage positively affect financial inclusion.

The above table demonstrates a substantial & positive correlation between mobile money adaptation and financial inclusiveness, indicating that financial inclusion increases as individuals show more adaptation of mobile money applications, with statistics of β=0.045, t=4.305, and p=0.016.

This finding strongly corroborates earlier research that has consistently highlighted the pivotal role of mobile money services in enhancing financial inclusion, particularly in developing economies where traditional banking access is limited. Specifically, our results align with studies by Weil & Mbiti (2011) and Gosavi (2018), who found that Action Money helps businesses improve family involvement and financial inclusion. It also supports the arguments that mobile money brings users closer to higher savings, borrowing, and money transfer capabilities.

By confirming this relationship within the diverse socio-economic landscape of Pakistan, our study reinforces the universal applicability of mobile money as a catalyst for financial inclusion and provides context-specific evidence for policymakers in similar emerging markets. On this basis, the proposition is accepted.

H2: Digital consumer protection positively mediates the linkage between mobile money adaptation and financial inclusion.

Table 4.7 demonstrates that consumer digital protection assists as a positive mediation variable in the connection between mobile money adaptation & financial inclusion, with statistics β = 0.087, t = 2.656, and p = 0.041. This suggests that the positive impact of mobile money adaptation on financial inclusion is strengthened when users perceive adequate protection.

This finding is consistent with the perspective that strong customer protection is necessary for digital financial services to build users' trust and confidence. It supports the assertion by Malady (2016) that DCP helps reduce voluntary financial exclusion stemming from actual data security concerns. Furthermore, our results align with the World Bank's view that protecting consumers using mobile money ensures users have adequate information for decision-making and access to effective problem-solving mechanisms to prevent fraud. The mediation observed in our study empirically validates the theoretical arguments put forth by CGAP (2017) regarding the importance of consumer protection in increasing people's trust in financial systems and institutions.

This study uniquely extends the existing literature by empirically demonstrating the *mediating* role of DCP, illustrating a clear pathway through which protective frameworks translate

into enhanced financial inclusion outcomes in a developing country context like Pakistan, a specific relationship that has been less explored in previous empirical models. Given these results, the proposition is accepted.

H3: Financial digital literacy positively moderates the linkages of mobile money adaptation and financial inclusion.

Regarding H-3, which inspects the affiliation between financial literacy, mobile money adaptation, & financial inclusiveness, the investigation yielded a *t*-value exceeding 8.905 with a corresponding p-value of 0.019. The significant positive moderation effect of Digital Financial Literacy (DFL) reveals that the relationship between mobile money adaptation & usage and financial inclusion is significantly strengthened when individuals possess higher levels of digital financial literacy. This implies that DFL empowers users to more effectively leverage mobile money services, maximising their benefits for financial inclusion.

This finding aligns with previous research suggesting that DFL is crucial for the successful uptake and utilisation of financial services, particularly in digital environments. Our results are consistent with arguments that higher levels of DFL enable individuals with the necessary skills and knowledge to navigate digital financial platforms, fostering financial resilience and independence. It specifically supports the notion that DFL aids in distinguishing between wants and needs, managing budgets, and preparing for financial security.

While the importance of DFL is acknowledged, our study provides robust empirical evidence for its *moderating* role in the mobile money-financial inclusion nexus within Pakistan. This novel finding highlights that simply providing access to mobile money is not enough; investing in DFL programs is critical to ensure that users can fully harness the transformative potential of these services, especially for underserved populations.

5.4. Model's Explanatory Power - R^2

R-squared values indicate the explanatory capacity of the statistical model, with acceptable values ranging from 0 to 1. Values approaching one signify superior predictive performance, while lower values indicate reduced accuracy. The current model demonstrates strong predictive capability for financial inclusion outcomes, achieving an R-squared value of 0.826, which represents high explanatory power.

Table. VIII: Prediction accurateness of dependent variable test

No.	Dependent variable	R^2
1	*Financial Inclusion*	0.83

5.5. F^2 Effect size

Effect sizes (f^2) of the structural model constructs were examined to determine each predictor construct's substantive contribution to the dependent variable(s). The f^2 values specify the contribution of each exogenous construct (MM, DCP, and FL) to the predictive variance of the

endogenous construct (R^2). Cohen et al. (1988) and Hair et al. (2017), f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effect sizes, respectively, in the context of PLS- SEM. The results are as follows:

MM ($f^2 = 2.636$): This construct holds an extremely high value for the effect size, indicating that it has a strong influence on the dependent variable(s). This means MM is an essential driving factor in the model and accounts for a high percentage of the variance explained in endogenous constructs. Such a high f^2 value epitomises how MM, as a dominant variable, further strengthens structural relationships, which demand explicit attention to their theoretical and practical implications. DCP ($f^2 = 0.204$): The construct DCP demonstrates a medium effect size, reflecting a moderate contribution to the predictive variation of the dependent variable. This indicates that DCP plays a meaningful, but not dominant, role in the model, influencing the outcome to a notable extent. FL ($f^2 = 0.095$): The construct FL has a small effect size, suggesting a limited but non-negligible impact on the dependent variable(s). While FL contributes to the model, its influence is relatively weak compared to MM and DCP, indicating a less critical role in driving the endogenous construct(s). These f^2 values collectively highlight the varying degrees of influence exerted by MM, DCP, and FL within the structural model. Because of the significant effect of MM, this implies that it is an important lever in affecting the outcome variable(s), while DCP and FL have a lesser contribution, but were still necessary to understand model dynamics completely.

Inferences may then be made from these findings toward practical recommendations, such as prioritizing strategies that enhance MM for maximal impact on the dependent constructs in question. Little effect is shown by the FL f^2 value of 0.095, and medium influence by MM, the f^2 value of 2.636, and DCP, the f^2 value of 0.205, concerning the dependent variable FI (Cohen et al., 1998). The research results demonstrate that mobile money adaptation & tech-based consumer protection exerts a moderate influence on financial inclusion outcomes, while the relationship between financial literacy and financial inclusion shows a limited effect. The model results are presented on the table below.

Table. IX: F-square effect size on dependent variable FI

No	Constructs	f^2	Effect
1	MM	2.64	Large
2	DCP	0.21	Medium
3	FL	0.10	small

Total Effect Size

	Original sample	Mean	Std Error	T stats	*P-values*
DCP > FI	0.331	0.341	0.160	2.079	0.037
DFL > FI	0.278	0.279	0.147	1.884	0.045
MM > DCP	0.484	0.851	0.054	1.982	0.000
MM > DFL	0.483	0.878	0.036	2.361	0.001
MM > FI	0.388	0.874	0.033	2.684	0.000

The analysis reveals that Mobile Money Adaptation & Usage (MM) exhibits the strongest relationships across multiple variables. MM demonstrates the most substantial impact on tech-based Consumer Protection (DCP) with a coefficient of 0.484 ($p < 0.000$), followed by its

influence on Digital Financial Literacy (DFL) with a coefficient of 0.483 ($p < 0.001$), and its effect on tech-based Financial Inclusion (FI) with a coefficient of 0.388 ($p < 0.000$).

Additionally, CP shows a positive correlation with FI, registering a coefficient of 0.331 ($p = 0.037$), whereas DFL similarly demonstrates a noteworthy positive connection with FI through a coefficient of 0.279 ($p = 0.046$). The substantial path coefficients combined with statistically significant p-values underscore MM's critical role in strengthening CP, DFL, and FI outcomes. These results feature the essential contribution of tech-based financial services in advancing financial inclusion initiatives within Pakistan's economic landscape.

5. Discussion of the Results

In today's rapidly evolving technological landscape, the financial sector has witnessed significant innovation, giving rise to what is now known as FinTech. The FinTech industry encompasses various technological solutions, with mobile payments representing a crucial component, facilitating online transactions through internet connectivity and smartphones across different service platforms. This research was designed to identify the key determinants influencing mobile payment adaptation patterns.

The study developed three hypotheses incorporating an independent variable, two mediating variables, & a dependent variable. Data collection targeted Pakistani residents from Lahore, Peshawar, Rawalpindi, & Islamabad, specifically focusing on individuals employed in public and private sectors, aged 20-65 years, representing both genders, with educational qualifications ranging from matriculation to doctoral degrees. The research gathered 413 responses, with female participants comprising the majority at 54% of the sample.

Regarding age demographics, the largest group consisted of 122 respondents aged 36-45 years, followed by 95 participants in the 25-35 age bracket, 83 in the 18-25 range, 65 between 46-55 years, and 48 respondents above 55 years. Educational background analysis revealed that most participants held graduate-level or advanced qualifications, suggesting that educational attainment influences perspectives on financial literacy, technology adaptation, and user satisfaction. Specifically, 49% possessed master’s degrees or higher qualifications, while 32% held professional certifications such as ICMA, CA, or ACCA.

Professional hierarchy analysis showed that 36% of respondents held officer positions, 22% served as team leaders, 19% worked as managers or department directors, 15% occupied director roles, & 8% functioned as executive management. The findings suggest that individuals in lower hierarchical positions are more inclined toward technology adoption compared to those in senior positions.

6. Conclusions

The research revealed strong interconnections between digital financial literacy, consumer protection, spending patterns, and mobile money adaptation within the financial accounting framework, drawing from data collected from MSMEs serving as intermediaries in Peshawar, Islamabad, Lahore, & Rawalpindi, The findings demonstrate that tech-based consumer protection plays a crucial role in facilitating the adaptation/ integration of mobile money and promoting financial inclusion, thereby confirming hypothesis H2. Effective consumer protection requires ensuring that users possess adequate knowledge for informed financial decision-making, preventing service providers from exploiting consumers unfairly. This necessitates establishing

accessible dispute resolution mechanisms to address conflicts between users and mobile money platforms. While consumer protection regulations may exist, their rigorous enforcement and consistent penalties for violations remain essential.

Furthermore, this research study establishes that (DFL) digital financial literacy significantly influences mobile money acceptance and spending behaviors in the financial inclusion context, validating hypothesis H3. Greater financial digital literacy prepares people with the essential competencies & understanding needed for navigating mobile money services effectively. This capability expansion broadens access to financial instruments and enables greater participation in formal financial systems.

For data validation, reliability analysis served as the primary method for weighing the credibility and quality of collected primary data used in the research study. The correlation matrix illustrates relationships amongst dependent & independent variables, with experimental evidence indicating strong positive associations among the studied components. Through regression analysis, three hypotheses underwent an examination. The empirical findings confirmed that all investigated factors maintain significant positive relationships with financial inclusion outcomes.

Although the paper provides meaningful insights, it faces limitations due to the lack of a comprehensive database of mobile payment users. Future research must recognize Pakistan's unique context, which differs significantly from other regions such as India with respect to economic conditions, statutory frameworks, & technological infrastructure. To strengthen subsequent literature, researchers should employ mixed-method tactics that combine both quantitative and qualitative practices. Additionally, investigations should extend beyond mobile payments to encompass other fintech innovations, including artificial intelligence chatbots, automated investment advisors, and person-to-person lending platforms. Increasing the size of a sample in future work will improve the reliability and applicability of results while providing deeper insights into how financial technology transforms banking practices within Pakistan's specific market environment.

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