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Unlocking financial inclusion and economic empowerment in rural Pakistan: The interplay of financial literacy and infrastructure development in the impact of digital wallets

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Abstract

This study investigates the relationship between the use of digital wallets and financial inclusion and economic empowerment in rural Pakistan. It also examines the mediating role of infrastructure development in these relations, while the moderating role of financial literacy is also addressed in the study. The research method adopted in the present study was quantitative. Data was collected from 476 respondents through an online questionnaire from a rural region of Pakistan, Dera Ghazi Khan. In the study, the positive relationship between the availability, usage, and control of digital wallets, inclusive access to finance, and the levels of economic development are evident from the results. Conversely, financial literacy did not act as a moderator to these relationships. The findings of this study revealed that infrastructure development moderates the effect that goes with the use of digital wallets in a positive way in terms of financial inclusion; nevertheless, it moderates the impact in a negative way when it comes to economic empowerment. These results indicate that despite the beneficial effects of digital wallets on financial access, the benefit arising from economic power may depend on the quality and accessibility of digital support. This paper offers vital information to policymakers, financial service firms, and development agents about the characteristics that affect the impact of digital financial services in enhancing financial access and economic opportunity among rural women in Pakistan. Future studies may investigate how digital wallet patterns change in the future and the quantitative and qualitative data of rural customers.

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1 Introduction

Pakistan is one of the emerging nations in which the increase in the adoption of electronic payment systems alternatives across mobile wallets has become distinctive (Mazhar et al., 2014; Mujtaba et al., 2023). The fact that it speaks of the future expansion of the user base of mobile wallets like JazzCash in Pakistan and Easypaisa, characterized by certain factors such as convenience, consumers' confidence in digital payments, and ease of use, is what creates awareness of this trend highlighted in Fig 1 (Best, 2023). An amalgamated connection with the legal angle is that mobile payment services in Pakistan cannot be discussed without the legal framework; mobile wallets associated with telecom segments mainly came into existence because telecom players partnered with banks to bring branchless banking to Pakistan (Best, 2023). This is why focusing on rural Pakistan is essential, as it makes up a large population that often remains untouched by conventional banking (Khan et al., 2019). Thus, with the help of digital wallets in these areas, the problem of financial exclusion and economic enfranchisement may be solved through increased availability of financial services (Masood et al., 2023; Wei et al., 2023). However, other factors, including infrastructural factors and financial literacy, are pivotal to the successful impact of digital wallets, just as important as the rate of adoption (Ali et al., 2023; Baig, 2022).

Shehzadi and Jameel (2023) argued that knowledge about finance could moderate the relationships between digital wallets and financial consequences and financial behaviors. A review of the literature from different studies based in various contexts identifies that these antecedents of innovations include convenience, security, perceptions of risks, simplicity, trust, and ease of use of digital financial services, which influences the positive perception of the users on their financial position (Dzogbenuku et al., 2010; Ibtasam et al., 2017; Nesse et al., 2017). In addition, digital wallets positively impact financial inclusion and, thus, financial enfranchisement, although this effect is mitigated by infrastructure enhancement, especially in rural areas (Hussaini & Chibuzo, 2018). The effectiveness of digital payment systems in targeting the excluded populations depends on the reliability of the underlying digital connectivity, including mobile networks and the Internet, especially in contexts where access to formal financial services is limited (Dzogbenuku et al., 2010). The interference between the use of the digital wallet, infrastructural advancement, and financial literacy is essential when looking at the effects of these factors on the financial accessibility and economic enfranchisement in Pakistan, given that rural areas have a weak financial infrastructure (Bukhari, 2023; Rahman et al., 2020). After successfully investigating these relations, Policymakers and practitioners can develop effective interventions and strategies so Pakistan's rural regions can enhance the efficiency and accessibility of digital payment systems. This would ensure that most deprived social groups have access to funds and thus increase financial liberalization.

The study aims to achieve the following objectives:

1. To assess the adoption and usage of digital wallets in rural Pakistan.
2. To examine the relationship between digital wallets, financial inclusion, and economic empowerment in rural Pakistan.
3. To investigate the moderating role of financial literacy in the impact of digital wallets on financial inclusion and economic empowerment.
4. To explore the mediating effect of infrastructure development in the relationship between digital wallets, financial inclusion, and economic empowerment.

2 Literature Review

This paper seeks to identify the latest peer-reviewed articles to analyze the relationship between adopting digital payment systems in rural regions, infrastructure development, and financial

literacy.

2.1 Background

The adoption of mobile wallets globally can be described as patchy, with different countries and sometimes even different regions presenting significantly different pictures (Niankara & Traoret, 2023; Treacher, 2018). Although the Asia-Pacific region includes nine of the top ten nations in mobile wallet usage, as per Best (2023), studying the proper growth and impact of such digital payment systems in emergent countries like Pakistan is also needed. Most noteworthy, Southeast Asian countries are now ahead in the numbers and transactions performed by mobile wallets; for instance, Singapore and Malaysia have indicated marked improvement in the usage of mobile wallets in the region (Ganbold, 2022).

Mobile wallets present in the Pakistani context are a definite step forward in the country's digital banking environment. (Ali et al., 2023; Baig, 2022; Masood et al., 2023). There has been a surge in the number of mobile wallet services available in Pakistan since the launch of EasyPaisa in 2009, such as JazzCash, NayaPay, and SadaPay (Shahzad & Arif, 2024). These digital wallets allow users to store money, make transfers, and make payments via mobile devices (Karim et al., 2022). They act as digital versions of conventional wallets. Mobile wallets have become a game-changing instrument for improving financial accessibility and inclusion in Pakistan because of the country's under-30 population and the extensive use of mobile phones (Shahzad & Arif, 2024). However, the present research primarily focuses on the more significant trends and adoption rates, which requires understanding the complex link between digital wallets, financial inclusion, and economic empowerment, particularly in rural regions (Shahzad & Arif, 2024).

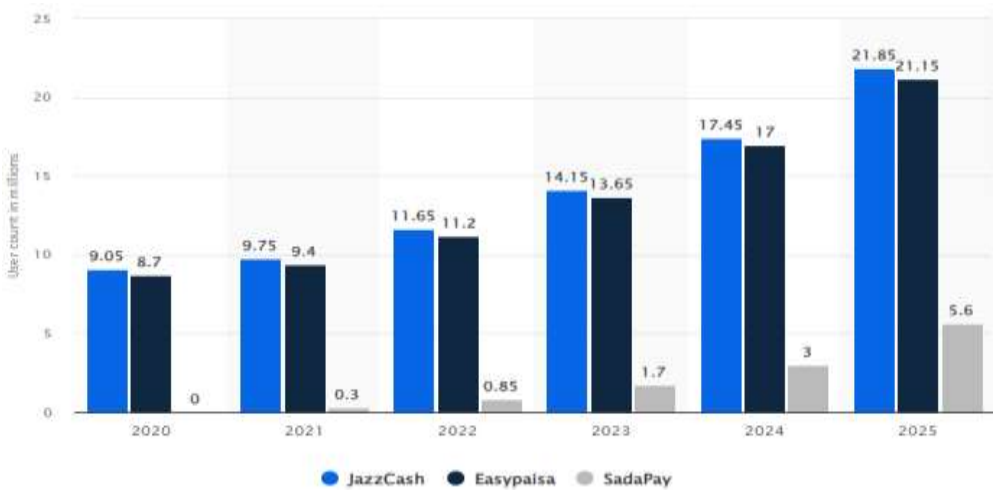

Figure 1: Distribution of mobile wallet usage among Pakistani users in 2020 with estimations for the subsequent years from 2021 to 2025 (in millions) (Best, 2023)

2.2 Digital Wallets

A digital wallet is an online tool that enables users to conduct transactions electronically. This comprises buying significant goods bought through a computer in an online store or small items purchased through a smartphone within a physical store (Mathiraj et al., 2019). Historically, scholars have paid substantial attention to adopting mobile payment systems and digital wallets, especially regarding their influence on financial access and economic agency (Karim et al., 2022; Levitin, 2017; Niankara & Traoret, 2023).

According to Deloitte (2023), the digital wallet is a critical solution that can improve financial

solutions in emerging markets, particularly in the developing world. Mobile money, which enables users of financial services and other related digital economy services to interact remotely using mobile phones and internet connections, has been deemed to have been propelled by advancements in digital wallets (Deloitte, 2023). Electronic purses are an essential proxy for a financial system in regions where the latter is scarce for managing money and effectuating transactions (Niankara & Traoret, 2023; Treacher, 2018). The literature also focuses on how digital wallets enhance users' convenience and reduce transaction costs. Bansal et al. (2018) established that risks connected with payment procedures are reduced through digital wallets since they do not involve using hard currency or other conventional means of paying for goods and services. This leads to more people having access to financial services while at the same time enhancing operational efficiency and reducing transaction costs.

In the same way, digital wallets are recognized as positively affecting individuals' financial behavior and awareness. According to Morgan (2021), digital wallets' transparency and the possibility of full disclosure allow people to control their spending and choose what is best for them financially. Electronic purses make users far more independent regarding their financial choices since they can see all the records and spending patterns in real time (Bukhari, 2023; Rahman et al., 2020).

2.3 Financial Literacy in Utilizing Digital Financial Services

Evidence shows that financial literacy aids or hinders people in predicting their ability to use digitally enabled services. Azeez and Akhtar (2021) opine that financial literacy positively affects the utilization of digital payment systems because financially literate people have more skills and confidence while dealing with their money online. This result underscored the significance of financial education programs to promote digital wallet usage among rural customers. Lusardi and Mitchell (2023) also note that financial literacy is essential in dealing with the complexity of modern financial environments and technologies such as mobile money. Being financially literate helps individuals to understand the characteristics and functioning of digital wallets, thus enabling them to be rational and use it to the maximum (Kusumapradana & Aisyah, 2022; Nuratika et al., 2022).

Moreover, Hastings et al. (2013) and Adam et al. (2017) proved a correlation between financial literacy level and different financial behaviors and operations such as investing, budgeting, and saving. Users who have more financial literacy are more likely to opt for e-financials like mobile wallets and are more likely to perform more responsible behaviors about their finances because it empowers them with the proper knowledge and skills about how to handle money well (Kusumapradana & Aisyah, 2022; Nuratika, 2022). External influential factors affect the extent of the link between financial literacy and the adoption of digital financial products and career-related factors. For instance, according to Lee et al. (2023), the expenses and availability of digital infrastructures are paramount to adopting payments for digitized transactions, particularly in areas with low indications of improvement. Hence, the deployment of infrastructure to enhance telecommunications to support the internet connection needs to be supplemented with financial literacy programs that would enhance the use of technology to support the delivery of the right financial services.

2.4 Facilitating Digital Payment Systems and Financial Inclusion

Niu et al. (2022) posited that for mobile payment services adoption and utility to be enhanced in rural areas, there is a need for consistent internet connection and mobile networks. Infrastructure positively affects financial and economic advancement since it enhances financial literacy by implementing digital wallets in typical operations (Hau et al., 2021). Some researchers have established that infrastructure development mediates the interaction between digital wallets and financial access (Olivia et al., 2023; Setiadi et al., 2023). Aziz and Naima (2021) posited that

digital payment systems are more effective in increasing financial inclusion when the digital format exists where physical banking services are inaccessible. Better infrastructure not only reduces access barriers but also builds the confidence and trust of rural people towards digital financial services, which, in turn, enhances their economic rights (Panagariya, 2022). This idea is well supported by Tay et al. (2022), who note that infrastructure development is necessary to support the uptake and use of digital payment systems. This is because individuals who reside in regions with inadequate infrastructure, including poor Internet connectivity or restricted networks, face many challenges each time they attempt to access and or use digital financial services (Kraus et al., 2022; Setiadi et al., 2023).

These challenges policymakers can tackle regarding the widespread uptake of digital payments; if they do so, there will be an encouraging environment through infrastructural development investment (Jorgensen & Beck, 2022). According to Kouladoum et al. (2022) and Takyi et al. (2022), the effect of the infrastructure on the interaction between digital wallets and financial inclusion is explained. Thus, digital payment systems are more effective in increasing economic inclusion where digital infrastructure is well developed due to the ability to cover a more significant percentage of the population and offer a seamless buying experience (Alam et al., 2021; Gunawan et al., 2020). Infrastructure improvement reduces barriers and improves rural communities' trust and confidence in digital financial services, which in turn assists in economically empowering them (Hardjono, 2021).

Furthermore, Bennett (2019) elaborates on how infrastructure development promotes entrepreneurship and innovation of the digital payment system. Technological development helps generate new approaches to payment kinds and business models in which financial service institutions obtain more opportunities to fulfill the needs of poor people (Geng & He, 2021). Fiscal policies regarding infrastructure provision might help policymakers facilitate competition and innovation in the digital payments system that benefits the consumers and aids economic development.

2.5 Theoretical Review

The Theory of Planned Behavior is another approach that can be used to understand people's behavioral intent concerning the usage of digital financial services (Astari et al., 2022). According to this theory, people's intentions to engage in an activity, say, using digital wallets, depending on their attitude, perceived social pressure to engage in the activity, and perceived control over the activity (Ajzen, 1991). There is a possibility that the attitude of people in rural areas of Pakistan toward digital wallets may change according to the financial literacy of the people, so in this regard, the advantages, as well as the disadvantages of the utilization of digital financial services, would also be seen (Persada et al., 2021). Therefore, financial literacy is a mediator that explains how consumers perceive the use of digital wallets and their actual use intentions.

In addition, the Technology Acceptance Model (TAM) provides insights into the variables that affect the usage of technology by people (Rosli et al., 2023). TAM suggests that perceived usefulness and ease of use are the principal factors influencing people's perceptions of using a specific technology (Davis, 1989). Infrastructure development arises as a mediator, which overpowers people's perceptions of the ease of use of digital wallets in rural areas of Pakistan that might require digital infrastructure. Advancements in technology simplify digital wallets and the possibility of using them for rural people. Examples of this include dependable cell networks and internet connection.

Moreover, the Social-Ecological Model (SEM) introduces or explains all the forms of behavior determinants, including socio-contextual, interpersonal, communal, and personal influences (Stokols, 1996). More universal environmental factors, such as infrastructure development, complement personal attributes such as financial literacy in a specific setting, i.e., the adoption of

digital wallets in rural Pakistan to determine the people's access to and use of digital financial services (Yang et al., 2021). Social factors such as social influence and brand influence, which look at overall the culture people in a society are being influenced to attend to, may also be influential to what people feel and do while using digital wallets, thus pointing to the need for socio-environmental perspective in capturing at digital financial inclusion (Ariffin et al., 2021).

By adopting multiple theoretical frameworks, the scholars may effectively understand the complex relations that define computerized wallets' impacts on rural Pakistan's financial access and economic emancipation.

2.6 Conceptual Model

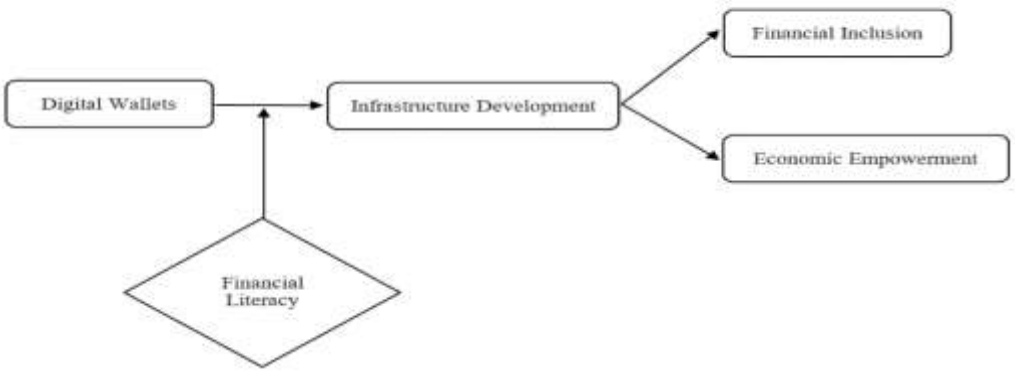

Figure 2: Conceptual Framework

2.7 Hypotheses of the Study

The study formulates the following hypotheses:

H1: *There is a relationship between digital wallets and financial inclusion in rural Pakistan.*

H2: *There is a relationship between digital wallets and economic empowerment in rural Pakistan.*

H3: *Financial literacy moderates the relationship between digital wallets and financial inclusion in rural Pakistan.*

H4: *Financial literacy moderates the relationship between digital wallets and economic empowerment in rural Pakistan.*

H5: *Infrastructure development mediates the relationship between digital wallets and financial inclusion in rural Pakistan.*

H6: *Infrastructure development mediates the relationship between digital wallets and economic empowerment in rural Pakistan.*

3 Methodology

The approach used in this study can be explained using Saunders's research onion model, which provides a systematic way of conducting research (Saunders et al., 2019).

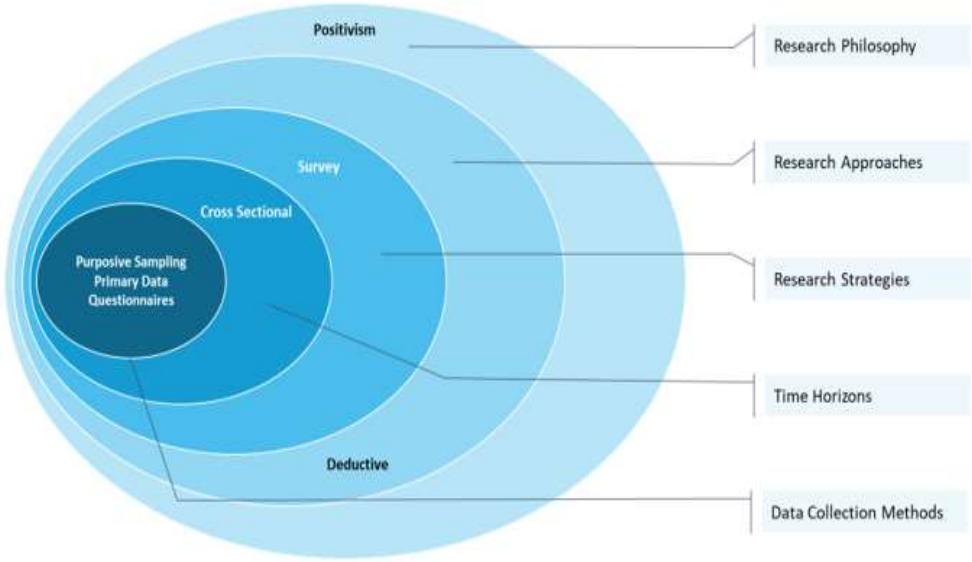

Figure 3: Research Methodology

3.1 Research Philosophy

The rationale for choosing positivism as the foundation for this study is that this research methodology employs scientific and statistical analysis to examine social issues (Bryman, 2016). This study aims to establish an empirical link between characteristics of digital wallets and financial inclusion/economic power among rural Pakistani women by employing a quantitative data analysis approach; therefore, it is positivist. This research employs a deductive approach, where data collected is used to test theories formulated from other research and literature reviews (Bryman, 2016). The deductive method makes it easier to analyze the interrelations between financial literacy, infrastructure development, and digital wallets' impact on financial inclusion. Survey research was adopted for this study because it uses structured questionnaires to collect information from a population sample (Saunders et al., 2019).

In data collection, Google Forms was employed as a tool to help distribute the survey and to seek the answers of the respective participants in the rural areas of Pakistan. This research has a cross-sectional time horizon because data was collected once to examine the relationship between the variables (Bryman, 2016). Researchers, just cross-sectional, may get a general idea of the current status and use of digital wallets and their impact on the financial inclusion of the rural population of Pakistan.

3.2 Data Collection

Google Forms was employed for data collection in this research. The survey was aimed at the residents of the rural city of Dera Ghazi Khan in the Punjab province of Pakistan, which has an estimated population of about 512,000 (Macro Trends, 2024). Thus, this city was chosen because the population and economic activities in this city included a relatively large number of rural residents, indicating rural areas in Pakistan (Misu & Alam, 2023). The study adopts the representativeness criterion of sample selection; the participants were selected to resemble the demographic variables of the rural population of Pakistan, enhancing the study's external validity.

Questionnaires were administered to 500 residents of rural areas in Pakistan. Out of the 500 targeted questionnaire participants, 476 volunteered their responses; the response rate was 95.2%

response rate. According to the conventions for research set out in the literature, this sample size was considered appropriate for the study. Hair (2009) suggests that the sample size of 400 is adequate for any statistical analyses, let alone regression analysis, which this study would use to analyze the relationship between the proposed variables. Moreover, a large sample size is believed to increase the credibility of the research conclusions and the ability to generalize them to other contexts (Saunders et al., 2019). Further, the sample composition enhances the generalizability of the findings to the context of Pakistan since the studied subjects' characteristics align with the rural population's demographics. Misu & Alam (2023) posit that about 70 percent of Pakistan's population resides in rural areas, which makes the area pertinent for economic development concerning money lending.

3.3 Questionnaire Development

This questionnaire's questions were obtained from similar studies on Digital Financial Services, Financial accession, and Economic Empowerment (Aker & Mbiti, 2010; Demirgüç-Kunt et al., 2020; Suri & Jack, 2016). The initial questions were asked after a literature review and consultations with the subject experts to ensure the validity of the instrument's content. The questionnaire was then pre-tested on 20 subjects from rural Pakistan to check the validity of the questions, their coverage, and relevancy.

As for the next step, the pilot participants' feedback was incorporated to improve or modify the questionnaire before it was made to behave in its final format. Cronbach's alpha procedure was employed to ascertain the internal consistency of the scales, and all the subscales had acceptable reliability coefficients ($\alpha > 0.70$). As per the principles of research ethics, participants' informed consent was obtained, participants' responses were anonymized, and data protection regulation was applicable as required (Saunders et al., 2019). It is necessary to mention that the study's primary purpose and informed consent were discussed with them, and they were allowed to withdraw from the study at any given time.

4 Analysis and Results

The data collected was analyzed using SPSS Version 29, and conclusions were made based on the empirical results. The analysis chapter thoroughly examines the study's results, covering demographic data, chi-square tests, normality tests, and mediation and moderation analyses.

4.1 Demographic Data

The respondents' demographic profile shows various ages, genders, educational attainment, and family income classes.

Table 1: Demographic Profile

	Gender					Education Level			Household Income		
	N	%		N	%		N	%		N	%
18-25	251	52.7%	Female	199	41.8%	Bachelor's	290	60.9%	Above 100,000	33	6.9%
26-35	147	30.9%	Male	272	57.1%	Doctorate or Professional	5	1.1%	Below 40,000	50	10.5%
36-45	60	12.6%	Prefer not to say	5	1.1%	Master's	149	31.3%	40,001 - 80,000	250	52.5%
46-55	17	3.6%				Pri. School	13	2.7%	80,001 -	143	30.0%
56+	1	0.2%				Sec. School	19	4.0%	100,000		

With 52.7% of participants in the 18–25 age group and 30.9% in the 26–35 age group, most participants are between 18 and 35. This suggests that the study's participants are comparatively young, which implies that younger people are interested in digital financial services. With 41.8% of the respondents being female and 57.1% male, the distribution of respondents' genders is equal, with a minor fraction choosing not to reveal their gender. The respondents' levels of education

vary, but a sizable fraction (60.9%) and (31.3%) possess bachelor's and master's degrees, suggesting a reasonably high level of education among the sample.

Additionally, a significant portion of the population (1.1%) has professional or doctoral degrees, indicating that these people are a highly educated subgroup. The sample covers various family income brackets; notable percentages fall into higher- and lower-income categories (above PKR 80,000 and PKR 100,000) and lower-income categories (below PKR 40,000 and PKR 40,001 - PKR 80,000). Due to the wide range of demographic features, it is possible to have a thorough grasp of the opinions and experiences of people from different socioeconomic backgrounds concerning digital financial services and how they affect financial inclusion in rural Pakistan.

4.2 Normality Test

The Kolmogorov-Smirnov One-Sample Five variables were tested for normalcy in the data distribution: ID (Infrastructure Development), EE (Economic Empowerment), DW (Digital Wallet), FL (Financial Literacy), and FI (Financial Inclusion). The test findings show that all variables' data distributions are normally distributed.

Table 2: Normality Test - **One-Sample Kolmogorov-Smirnov Test**

				FI	DW	EE	FL	ID
N				476	476	476	476	476
Normal Parameters [b]	Mean			2.87	2.39	2.57	2.3895	2.3992
	Std. Deviation			0.418	0.799	0.738	0.44388	0.47204
Most-Extreme Differences	Absolute			0.524	0.366	0.436	0.094	0.098
	Positive			0.38	0.222	0.278	0.094	0.091
	Negative			-0.524	-0.366	-0.436	-0.09	-0.098
Test Statistic				0.524	0.366	0.436	0.094	0.098
Asymp.				0	0	0	0	0
	Sig.			0	0	0	0	0
Monte Carlo	99% Confidence Interval		Lower Bound	0	0	0	0	0
			Upper Bound	0	0	0	0	0

a. The test distribution is Normal, b. It was calculated from data, c. Lilliefors Significance Correction, and d. Lilliefors' method is based on 10,000 Monte Carlo samples with a starting seed of 2000000.

At a significance level of 0.05, the test statistic for each variable is compared to the crucial value. The test statistic measures how much the empirical cumulative distribution function of the sample data differs from the normal distribution's cumulative distribution function. The null hypothesis states that the data distribution is non-normal and is rejected in every instance where the test statistic exceeds the critical value. Additionally, for every variable, the values of the Monte Carlo significance (2-tailed) and asymptotic significance (2-tailed) are presented as 0.000. This provides compelling evidence in favor of the normalcy assumption as it shows how unlikely it is to see the test findings if the non-normality assumption is valid.

4.3 Chi-Square Tests

Because the variables in this research are categorical, the chi-square test is suitable for evaluating the relationship between the usage of digital wallets (an independent variable) and financial inclusion/economic empowerment (dependent variables). In particular, the respondents' digital wallets can be classified as either present or absent, and categorical answers are used to quantify financial inclusion and economic empowerment.

Table 3: Chi-Square Test for H1

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.916[a]	4	0.018
Likelihood Ratio	12.292	4	0.015
Linear-by-Linear Association	5.983	1	0.014
N of Valid Cases	476		

a. 4 cells (44.4%) have an expected count of less than 5. The minimum expected count is 2.05.

With four degrees of freedom and a corresponding p-value of 0.018, the Pearson Chi-Square test for H1 in Table 3 produced a result of 11.916. A chi-square value of 12.292 with 4 degrees of freedom and a p-value of 0.015 were obtained using the Likelihood Ratio test. In addition, the Linear-by-Linear Association test obtained a chi-square value of 5.983 with one degree of freedom and a p-value of 0.014. Given that the p-values for these tests are below the traditional cutoff point of 0.05, it is clear that there is a statistically significant association between digital wallets and financial inclusion in rural Pakistan. These findings imply that variations in financial inclusion in Pakistan's rural areas relate to people's use of digital wallets. In particular, the results of the chi-square tests show a strong correlation between the degree of financial inclusion among those living in rural regions and the usage of digital wallets. Consequently, the data is consistent with the theory that digital wallets and economic inclusion in Pakistan's rural areas are positively correlated.

Table 4: Chi-Square Test for H2

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	43.838[a]	4	0.000
Likelihood Ratio	39.811	4	0.000
Linear-by-Linear Association	34.449	1	0.000
N of Valid Cases	476		

a. 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 12.97.

The chi-square test findings support the hypothesis that digital wallets and economic empowerment in rural Pakistan are positively correlated. With four degrees of freedom, the Pearson Chi-Square test statistic was 43.838, resulting in a p-value of 0.000. Similar results were obtained for the Linear-by-Linear Association test statistic (34.449 with a p-value of 0.000) and the Likelihood Ratio test statistic (39.811, p-value of 0.000). The fact that these p-values are much lower than the conventional significance threshold of 0.05 suggests a strong correlation between digital wallets and economic empowerment. According to these results, people in rural Pakistan who use digital wallets are more likely to feel more empowered financially. This positive relationship suggests that people's economic agency, financial autonomy, and overall empowerment are enhanced when digital payment channels are adopted and used. In particular, digital wallets allow users to deal cashlessly, access financial services from a distance, and manage their money more effectively. These features enable users to participate more actively in the economy and make wise financial choices. Digital wallets are becoming more and more common in Pakistan's rural regions. They are essential in bridging the gap between conventional financial services and underserved communities, promoting greater financial inclusion and economic empowerment.

4.4 Moderation and Mediation Analysis

Table 5: Moderation Analysis for H3 using Hayes Process Macro-Model 1-Outcome Variable: FI

	R	R-sq	MSE	F	df1	df2	p
	0.1945	0.0378	0.2085	6.1833	3.0000	472.0000	0.0004
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.5410	0.0209	121.40	0.0000	2.4999	2.5821	
DW	0.0694	0.0402	1.7282	0.0846	-0.0095	0.1483	
FL	0.1804	0.0472	3.8212	0.0002	0.0876	0.2731	
Int_1 (DW x FL)	0.0679	0.0885	0.7667	0.4436	-0.1061	0.2419	
Highest Order	**R2-chng**		**F**	**df1**	**df2**	**p**	

Unconditional Interaction					
X*W (DW x FL)	0.0012	0.5879	1.0000	472.00	0.4436

Hypothesis 3 posits that financial literacy moderates the relationship between the use of digital wallets and financial inclusion in rural Pakistan. The moderation analysis, however, indicates that this interaction effect is not statistically significant. The interaction term (DW x FL) has a coefficient of 0.0679 with a p-value of 0.4436, suggesting that the interaction effect is insignificant at the 5% level. This means that the impact of digital wallets on financial inclusion does not significantly vary with levels of financial literacy. Therefore, while both digital wallets (DW) and financial literacy (FL) individually contribute to financial inclusion (FI), financial literacy does not significantly enhance or diminish the effect of digital wallets on financial inclusion in this context.

Table 6: Moderation Analysis for H4 using Hayes Process Macro - Model 1 - Outcome Variable: EE

Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.1978	0.0391	0.3822	6.4036	3	472	0.0003
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.7208	0.0283	96.0086	0.0000	2.6651	2.7765	
DW	0.066	0.0544	1.2134	0.2256	-0.0409	0.1728	
FL	-0.266	0.0639	-4.1626	0.0000	-0.3916	-0.1405	
Int_1 (DW x FL)	0.0794	0.1199	0.6623	0.5081	-0.1562	0.315	
Highest Order Unconditional Interaction	**R2-chng**	**F**	**df1**	**df2**		**p**	
X*W (DW x FL)	0.0009	0.4387	1	472		0.5081	

Hypothesis 4 posits that financial literacy moderates the relationship between digital wallets and economic empowerment in rural Pakistan. The results of the moderation analysis indicate that the interaction term (DW x FL) is not statistically significant (coefficient = 0.0794, p = 0.5081). This suggests that financial literacy does not significantly influence the effect of digital wallets on economic empowerment. While financial literacy has a significant direct impact on economic empowerment (coefficient = -0.266, p = 0.0000), it does not alter the impact of digital wallet usage on economic empowerment. Therefore, financial literacy does not moderate the relationship between digital wallets and economic empowerment in this context.

Table 7: Moderation Analysis for H5 using the Hayes Process

Outcome Variable: ID							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.1101	0.0121	0.2206	5.8195	1	474	0.0162
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.043	0.1492	13.693	0	1.7498	2.3362	
DW	0.0994	0.0412	2.4124	0.0162	0.0184	0.1804	
Standardized Coefficients	**coeff**						
DW	0.1101						
Outcome Variable: FI							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.1822	0.0332	0.209	8.117	2	473	0.0003
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	1.9506	0.1716	11.368	0	1.6134	2.2878	
DW	0.0573	0.0404	1.4198	0.1563	-0.022	0.1366	
ID	0.1606	0.0447	3.5914	0.0004	0.0727	0.2485	
Standardized Coefficients	**coeff**						
DW	0.0646						
ID	0.1634						
Total Effect Model							
Outcome Variable: FI							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.0826	0.0068	0.2143	3.2542	1	474	0.0719
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.2787	0.1471	15.495	0	1.9897	2.5676	
DW	0.0733	0.0406	1.8039	0.0719	-0.0065	0.1531	
Standardized Coefficients	**coeff**						
DW	0.0826						
Total, Direct, and Indirect Effects of X on Y							
Total Effect of X on Y	**Effect**	**SE**	**t**	**p**	**LLCI**	**ULCI**	**c_cs**
	0.0733	0.0406	1.8039	0.0719	-0.0065	0.1531	0.0826
Direct Effect of X on Y	**Effect**	**SE**	**t**	**p**	**LLCI**	**ULCI**	**c'_cs**
	0.0573	0.0404	1.4198	0.1563	-0.022	0.1366	0.0646
Indirect Effect(s) of X on Y	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**			
ID	0.016	0.0085	0.002	0.0342			
Completely Standardized Indirect Effect(s) of X on Y	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**			
ID	0.018	0.0095	0.0022	0.0383			

Hypothesis 5 suggests that infrastructure development mediates the relationship between digital wallets and financial inclusion in rural Pakistan. The mediation analysis results indicate that digital wallets (DW) significantly predict infrastructure development (ID) (coefficient = 0.0994, p = 0.0162), and infrastructure development significantly predicts financial inclusion (FI) (coefficient = 0.1606, p = 0.0004). The indirect effect of digital wallets on financial inclusion through infrastructure development is also significant (Effect = 0.0160, BootLLCI = 0.0020, BootULCI = 0.0342). Therefore, infrastructure development partially mediates the relationship between digital wallets and financial inclusion, confirming that infrastructure improvements can enhance the effectiveness of digital wallets in promoting financial inclusion in rural Pakistan.

Table 8: Moderation Analysis for H6 using the Hayes Process

Outcome Variable: ID							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.1101	0.0121	0.2206	5.8195	1	474	0.0162
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.043	0.1492	13.693	0	1.7498	2.3362	
DW	0.0994	0.0412	2.4124	0.0162	0.0184	0.1804	
Standardized Coefficients	**coeff**						
DW	0.1101						
Outcome Variable: EE							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.2099	0.0441	0.3794	10.8984	2	473	0
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	3.0411	0.2312	13.1552	0	2.5869	3.4954	
DW	0.0925	0.0544	1.7016	0.0895	-0.0143	0.1994	
ID	-0.2716	0.0602	-4.5085	0	-0.39	-0.1532	
Standardized Coefficients	**coeff**						
DW	0.077						
ID	-0.2039						
Total Effect Model							
Outcome Variable: EE							
Model Summary	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
	0.0545	0.003	0.3949	1.4125	1	474	0.2352
Model Coefficients	**coeff**	**SE**	**t**	**p**	**LLCI**	**ULCI**	
Constant	2.4862	0.1996	12.4538	0	2.0939	2.8785	
DW	0.0655	0.0551	1.1885	0.2352	-0.0428	0.1739	
Standardized Coefficients	**coeff**						
DW	0.0545						
Total, Direct, and Indirect Effects of X on Y							
Total Effect of X on Y	**Effect**	**SE**	**t**	**p**	**LLCI**	**ULCI**	**c_cs**
	0.0655	0.0551	1.1885	0.2352	-0.0428	0.1739	0.0545
Direct Effect of X on Y	**Effect**	**SE**	**t**	**p**	**LLCI**	**ULCI**	**c'_cs**
	0.0925	0.0544	1.7016	0.0895	-0.0143	0.1994	0.077
Indirect Effect(s) of X on Y	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**			
ID	-0.027	0.0134	-0.0557	-0.0033			
Completely Standardized Indirect Effect(s) of X on Y	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**			
ID	-0.0225	0.011	-0.0461	-0.0027			

Hypothesis 6 posits that infrastructure development mediates the relationship between digital wallets and economic empowerment in rural Pakistan. The analysis indicates that digital wallets (DW) significantly predict infrastructure development (ID) (coefficient = 0.0994, p = 0.0162), and infrastructure development has a significant negative effect on economic empowerment (EE) (coefficient = -0.2716, p = 0.0000). The indirect impact of digital wallets on economic empowerment through infrastructure development is significant and negative (Effect = -0.0270, BootLLCI = -0.0557, BootULCI = -0.0033). Therefore, infrastructure development mediates the relationship between digital wallets and economic empowerment, suggesting that while digital wallets facilitate infrastructure improvements, their current state might need to sufficiently empower economically in rural Pakistan.

5 Discussions

The study's conclusions complement and add to the body of knowledge already available on digital wallets, financial inclusion, and economic empowerment in rural areas.

The chi-square test produced statistically significant findings for H1, which proposed an association between digital wallets and financial inclusion (Pearson Chi-Square = 11.916, p = 0.018). This implies a connection between financial inclusion in rural Pakistan and digital wallets. The chi-square test likewise yielded significant findings (Pearson Chi-Square = 43.838, p = 0.000) for H2, which suggested an association between digital wallets and economic empowerment. This indicates that there is a relationship between digital wallets and economic empowerment. The study supports earlier studies on digital wallets and their beneficial effects on financial inclusion and economic empowerment. The importance of digital wallets in advancing financial inclusion programs was highlighted by Deloitte (2023), especially in areas with weak conventional banking infrastructure. The research findings corroborate the claim made by Bansal et al. (2018) that digital wallets improve accessibility to financial services by streamlining payment procedures and lowering transactional friction. The moderation analyses for H3 and H4 suggest that financial literacy does not significantly moderate the relationship between digital wallets and financial inclusion (p = 0.4436) or economic empowerment (p = 0.5081). While financial literacy has a significant direct effect on economic empowerment (coefficient = -0.266, p = 0.000), it does not enhance or diminish the impact of digital wallets on these outcomes. This finding contrasts with Azeez and Akhtar (2021), who found that financial literacy positively influenced the adoption of digital payment systems. The lack of significant moderation effects suggests that the influence of financial literacy may vary depending on the specific context and objective under investigation.

The mediation analysis for H5 indicates that infrastructure development partially mediates the relationship between digital wallets and financial inclusion. Digital wallets significantly predict infrastructure development (coefficient = 0.0994, p = 0.0162), and infrastructure development significantly predicts financial inclusion (coefficient = 0.1606, p = 0.0004). The significant indirect effect (Effect = 0.0160, BootLLCI = 0.0020, Boot ULCI = 0.0342) confirms that infrastructure improvements enhance the effectiveness of digital wallets in promoting financial inclusion. This aligns with previous studies, such as those by Niu et al. (2022) and Tay et al. (2022), which emphasized the critical role of reliable digital infrastructure in expanding the functionality and reach of mobile payment services.

Contrary to H5, the analysis for H6 reveals that infrastructure development mediates the relationship between digital wallets and economic empowerment negatively. Digital wallets significantly predict infrastructure development (coefficient = 0.0994, p = 0.0162), but infrastructure development significantly negatively affects economic empowerment (coefficient = -0.2716, p = 0.0000). The significant indirect effect (Effect = -0.0270, BootLLCI = -0.0557, Boot ULCI = -0.0033) suggests that while infrastructure development facilitated by digital wallets is present, its current state may not sufficiently support economic empowerment in rural Pakistan. This negative mediation effect highlights potential inadequacies or inefficiencies in the existing infrastructure that might hinder the full realization of economic benefits.

Table 9: Summary of the results

Hypothesis	Test	Statistic	p-value	Conclusion
H1: Relationship between digital wallets and financial inclusion	Pearson Chi-Square	11.916	0.018	Significant relationship
H2: Relationship between digital wallets and economic empowerment	Pearson Chi-Square	43.838	0.000	Significant relationship
H3: Financial literacy moderates the relationship between digital wallets and financial inclusion	Interaction term (DW x FL)	0.0679	0.4436	Not significant
H4: Financial literacy moderates the relationship between digital wallets and economic empowerment	Interaction term (DW x FL)	0.0794	0.5081	Not significant
H5: Infrastructure development mediates the relationship between digital wallets and financial inclusion	Indirect effect (DW > ID > FI)	0.0160	[0.002, 0.0342]	Significant mediation
H6: Infrastructure development mediates the relationship between digital wallets and economic empowerment	Indirect effect (DW > ID > EE)	-0.0270	[-0.0557, -0.0033]	Significant mediation, negative effect

These studies significantly help to understand the role of digital wallets in the financial inclusion and economic advancement of women in rural Pakistan and the moderating role of financial literacy and infrastructural development in this context.

Thus, it is pertinent to recognize the possibility of limitations in this study. One possible threat to validity is method variance, which refers to using data obtained from a single source and by a single means (Podsakoff et al., 2003). In this regard, future research could contemplate different ways, such as employing multiple sources or different data collection techniques to ensure the validity of the results. Also, the study was carried out in a particular rural setting in Pakistan, and the findings cannot be easily generalized to other settings or populations. Further research could be conducted in other regions to establish its validity or again increase the sample size by including participants from rural and urban regions to compare the results concerning the interaction between digital wallets, financial inclusion, and economic upliftment. However, it is essential to note that this study's results can provide much-needed policy implications for policymakers, financial

service providers, and development practitioners particularly interested in targeting the economic empowerment and financial inclusion of Pakistan's rural population. The findings affirmed digital wallets as a way of promoting financial and economic inclusion while presenting infrastructural development as a way of optimizing the opportunities offered by mobile money services.

5.1 Conclusion

To sum up, the research evidence points to the fact that digital wallets are highly correlated with financial inclusion and economic enfranchisement among rural cities of Pakistan, but financial literacy, as per the findings, does not mediate these relationships. However, in this regard, infrastructure development was found to be significant. Partial Median Studies also revealed that while infrastructure development partly mediates between mobile wallet and financial inclusion, it negatively mediates between mobile wallet and economic empowerment. The issues raised in the study reveal the importance of adopting digital wallets to enhance the community's opportunity to gain improved financial access and empower Pakistan's rural economy. Based on empirical evidence, the results show that using the digital wallet positively affects the outcomes highlighted above. It also stresses other factors, such as infrastructural development and financial knowledge, influencing how people embrace and use digital financial services.

5.2 Recommendations, Practical Implications & Future Directions

The present study's findings enable research to make several recommendations for enhancing the adoption and utilization of digital wallets in the rural areas of Pakistan. First, governments should mobilize funds to improve rural connectivity by enhancing internet connections and cell networks. This would increase the usage and the uptake of digital financial services among underprivileged groups as it would be easier to access them. Second, financial literacy programs must be tailor-made to the rural population's needs and focus on acquiring knowledge and understanding the digital payments environment. Therefore, the practical relevance of the study's findings pertains to several factors involved in financial access and poverty alleviation in and around rural Pakistan. The findings of this study may assist the financial service firm in developing and marketing mobile wallets that are more in line with rural customers' needs and wants. Understanding the factors that influence the use of the digital wallet can help the suppliers develop strategies to overcome challenges and enhance the mean user experience. Similarly, these outcomes could be helpful for the decision-making process of developing further the programs and policies that need to enhance the environment necessary for the deployment of digital financial services. Longitudinal research that tracks the adoption and utilization of digital financial products over time may help explain the factors influencing rural customers' usage and loyalty. Additionally, focus and interviews may be other research methods that can be applied to capture rural customers' multifaceted attitudes and perceptions toward digital wallets. Further, studies on other countries/regions can serve as valuable data concerning the contextual factors that may affect the levels and nature of acceptance and effectiveness of using digital wallets.

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