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FinTech and financial inclusion in Pakistan: Investigating the mediating role of digital financial literacy and the moderating effect of perceived regulatory support

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Abstract: FinTech enhances financial inclusion by providing easy access to financial services and affordability for the unbanked population. This study aims to examine how the use of FinTech promotes financial inclusion in Pakistan, considering digital financial literacy as an influencing variable and perceptions of support from financial regulations as a moderating factor. The research investigates individual adoption of FinTech and the benefits of easier access to official financial services. Data was collected from 600 users of financial technology in Pakistan and analyzed using PLS-SEM. The findings indicate that trust, quality of service, and security positively influence FinTech usage in Pakistan. FinTech facilitates greater participation of underserved communities in financial services by reducing access costs. The study demonstrates that digital financial literacy bridges the gap between financial technology and broader financial inclusion, with perceptions of supportive regulations further strengthening this relationship. These insights provide valuable guidance for policymakers, regulators, and FinTech businesses operating in Pakistan.

Keywords: *Digital financial literacy, Financial inclusion, FinTech, Perceived regulatory support.*

1. Introduction

Although there have been important improvements in Pakistan's financial sector, a large number of people are still excluded from official finance. Many individuals in remote rural and less developed areas struggle to access basic financial services. The report from the World Bank in 2021 emphasizes that this problem persists and that new, local solutions are absolutely necessary [1]. Using FinTech's digital technology is now widely believed to help bridge the gaps between those who have access to services and those who do not [2, 3]. By using smartphones and apps, the FinTech sector in Pakistan offers people new, convenient, and safe ways to manage their finances. Apps for mobile banking, mobile wallets, and services where people can lend and borrow money from each other have become popular, mainly with young people and those without a regular bank account [4]. They not only cost less than old-fashioned services but also eliminate the need to travel to a bank in person, making them very important for people living far from branches or who cannot use traditional services [5]. Lately, the government in Pakistan has acknowledged that FinTech is capable of providing financial opportunities to more people. With Raast and digital onboarding regulations in place, people are embracing digital financial services faster than before. Nevertheless, there are still issues to overcome. People using the internet are still dealing with issues like digital fraud, problems with privacy, and uncertain regulations [6, 7]. Since these risks are present, using digital financial literacy safely and properly has become necessary [8].

One should understand the difference between financial literacy (an overview of financial matters) and digital financial literacy, which relates to the knowledge and skills to handle digital finance [9, 10].

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Those who understand finances in Pakistan may find it hard to manage digital transactions without the proper digital financial knowledge needed for safe and sound decisions [11, 12]. Its focus is on identifying the way FinTech and financial inclusion relate in Pakistan, considering digital financial literacy to mediate and judging rules and regulations as modulating factors. Although previous research has looked into the main reasons for using FinTech and how it influences financial inclusion [13, 14] the connection between FinTech and financial literacy has not yet been recognized in Pakistan. Additionally, although literature examines how regulations influence FinTech adoption, their role in developing financial inclusion has not been thoroughly studied [15, 16].

It adds value to what we understand in the field of behavioral finance in three important ways:

1. Therefore, high use of FinTech services does not automatically lead to greater financial inclusion, but it depends on other factors, such as digital financial literacy.
2. It makes clear that digital financial literacy is important for the expansion of FinTech in reaching more people.
3. This research concludes that perceptions of regulatory help enhance the way FinTech impacts financial inclusion in Pakistan's financial sector.

This paper continues as follows: Section 2 reviews existing studies and relevant theories, Section 3 describes how the study was carried out, Section 4 examines the findings and their implications, and Section 5 offers conclusions and suggestions for further research.

2. Theoretical Foundation, Literature Review, and Hypotheses Development

2.1. Theoretical Foundation

Two important theories are the basis of this study: the Unified Theory of Acceptance and Use of Technology (UTAUT2) and the Value-Based Adoption Model (VAM). Such models provide explanations for users' expected and observed use of technology related to financial services. Many studies have applied the UTAUT2 model to forecast technology adoption in digital finance and mobile banking [17, 18]. It provides meaningful details about the impact of performance expectancy, effort expectancy, social influence, and facilitating conditions on technology use. In Pakistan, this research follows the UTAUT2 model because rapid smartphone growth and new digital ideas make digital financing more likely. VAM draws attention to the value perceived by users, which comes from understanding the differences between the benefits of using a system and the sacrifices required [19, 20]. Pakistan's use of FinTech is mainly controlled by how much people believe it is trustworthy, provides good service, and is secure enough, due to prior financial scams and non-existent consumer protection. When users understand finance more online and get support from regulators, they are more satisfied and come to see it as valuable [21].

2.2. Trust and FinTech Use

Trust plays an important role in shaping a person's decision to use FinTech services. It means how much people believe that digital financial services are secure, reliable, and ethically practiced [13]. Because fraud and data misuse are rising on the internet in Pakistan, people rely on trust when deciding to use FinTech services [22, 23]. It has been proven that when trust is high, people think fewer risks exist and are more likely to remain loyal customers [24, 25].

H_1: Trust significantly and positively influences the use of FinTech services.

2.3. Service Quality and FinTech Use

The quality of service greatly matters in making people satisfied and in encouraging them to keep using FinTech platforms [26, 27]. In Pakistan, since traditional banks do not always meet users' needs, FinTech platforms that are reliable, convenient, and user-friendly have an advantage [28]. If the service is of high quality, it increases the user's perception of its value and leads them to use it again [29].

H_2: Service quality significantly and positively influences the use of FinTech services.

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2.4. Perceived Security and FinTech Use

Safety of financial information and processes is considered perceived security and depends on one's own opinion [30]. Since there are many cyberattacks, identity theft, and digital scams in Pakistan, many people consider safety to play a major role when adopting fintech services [27]. Making FinTech more secure encourages users to trust the service and want to stay with it, Putri et al. [31].

H_3: Perceived security significantly and positively influences the use of FinTech services.

2.5. FinTech Use and Financial Inclusion

The use of FinTech reduces physical and administrative barriers, enabling rural, unbanked people in Pakistan to access financial services. Recently, Easypaisa, JazzCash, and Raast have provided more affordable and convenient options in financial services, making traditional banking more accessible to many [32]. The situation is especially significant in Pakistan, given its large, unconventional economy and heavy use of cash.

H_4: The use of FinTech services has a significantly positive influence on financial inclusion.

2.6. FinTech Use and Digital Financial Literacy

Besides financial services, such platforms in Pakistan also serve as teachers on digital topics. Many applications provide tutorials, help with common questions, budgeting tools, and advice on using money responsibly within their apps [33, 34]. A number of platforms include games to help people have fun while studying finances [12]. These steps help improve digital financial literacy (DFL), mainly among youth and women, who are usually not included in Pakistan's financial system.

H_5: The use of FinTech services significantly and positively influences digital financial literacy.

2.7. Digital Financial Literacy and Financial Inclusion

People who have digital financial literacy can handle, evaluate, and apply digital financial services safely [35, 36]. DFL gives Pakistan's citizens extra confidence when making payments, handling investments, and using digital loans. If DFL increases, individuals can engage more with banks, providing them with greater opportunities for using financial services [37].

H_6: Digital financial literacy significantly and positively influences financial inclusion.

2.8. Digital Financial Literacy as a Mediator

Digital financial skills are necessary to help individuals fully utilize the financial services provided by FinTech. Some studies have identified how digital consumer protection and digital marketing serve as mediators, but there is limited research on this topic in Pakistan. The study addresses this gap by proposing that DFL acts as a primary mediator.

H_7: Digital financial literacy mediates the relationship between the use of FinTech and financial inclusion.

2.9. Perceived Regulatory Support as a Moderator

People believe that financial regulators supply clear and safe guidelines for companies in the fintech industry [38]. Earlier, the control over digital finance in Pakistan was unclear, but recent plans from the State Bank of Pakistan (SBP) have enhanced users' trust. Tighter rules may give more people a reason to use fintech solutions [39].

H_{1a}: Perceived regulatory support moderates the relationship between FinTech use and financial inclusion, such that higher (lower) levels of perceived regulatory support strengthen (weaken) this relationship.

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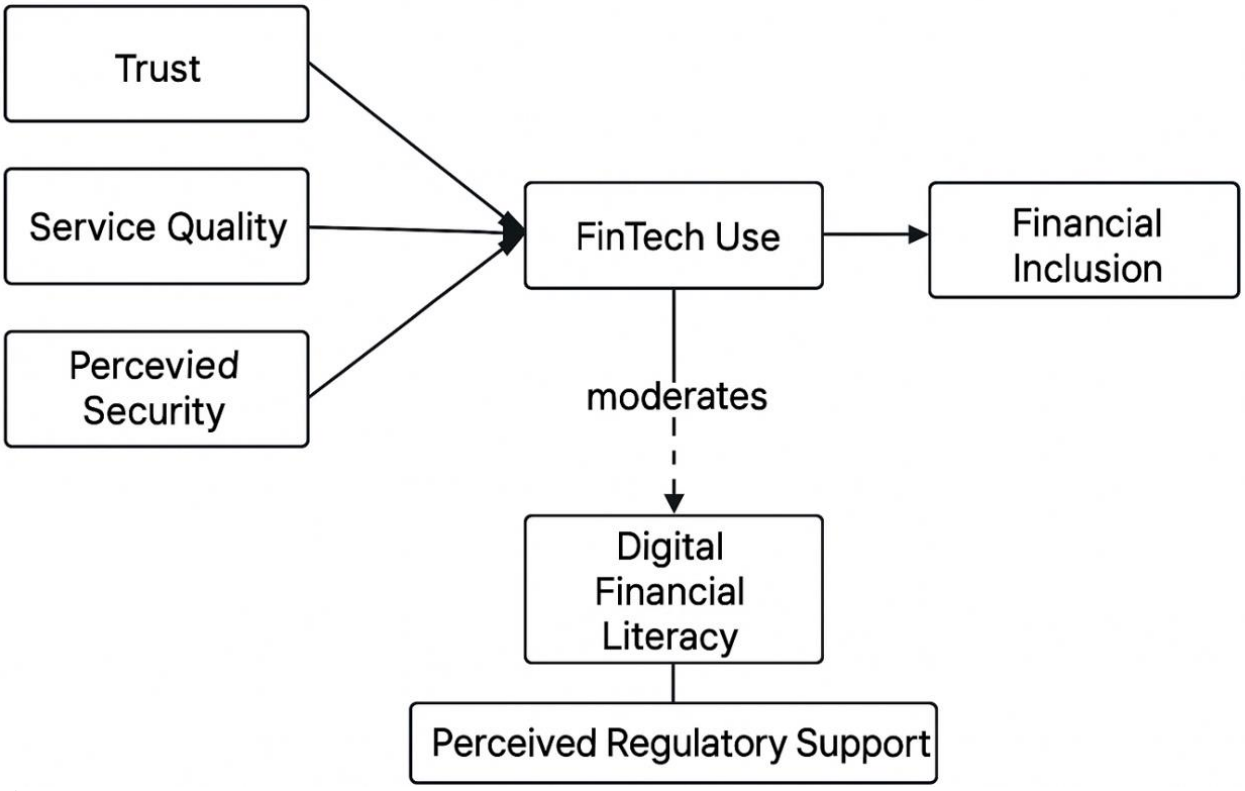

Figure 1.
Conceptual Framework.

3. Research Methodology

3.1. Measurement Development

For the objectives to be achieved, we formed a detailed research framework (as shown in Figure 1). Seven constructs were used in this study, and each was measured by items taken from validated scales that have been used in past research. Singh and Srivastava [40] and Kumar et al. [41] items were used to measure trust and perceived security was measured using questions from George and Sunny [27]. Based on the work of Zhou [42], the service quality scale was used and the perceived regulatory support items were adapted from Chandra et al. [30]. According to the scale developed by Venkatesh et al. [43], users' FinTech experience was measured through digital payments, wealth management, credit services, and insurance services. Besides using FinTech for payments, I also like to invest using the different apps available. Xia et al. [44] and Xie et al. [45] are among the recent studies that have looked at these measures in similar emergent situations. Questions about DFL were taken from Ravikumar et al. [8], and questions about financial inclusion were taken from Okello Candiya Bongomin and Ntayi [46]. All the items were asked on a scale where Strongly Disagree is 1 and Strongly Agree is 5. Respondents first filled out a section with demographic questions, and then they answered the questions about the study's various variables. Those who agreed to participate in the study were provided with privacy and confidentiality. Two fintech experts and four academics reviewed the questionnaire to ensure its appropriateness for Pakistan. Thirty participants were tested in a pilot study to assess the accuracy and ease of use of the scale. The feedback allowed me to modify the wording and the order of the questions.

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3.2. Sample and Data Collection

The purpose of the study was to examine the pattern of use among people who are currently using FinTech services in Pakistan. There was no official list of FinTech users, and that is why convenience sampling was chosen, as it is a widely used method in similar studies Alrawad et al. [13]. From September to November 2023, data were gathered for this work. Due to logistical challenges and the fact that most FinTech users live in various regions, data collection was conducted via Google Forms. Participants could access the survey through a clickable link shared on digital platforms such as WhatsApp, Facebook, LinkedIn, and email. The snowball sampling method was employed, whereby initial survey participants were asked to encourage other FinTech users within their network to participate. This technique is commonly used in both academic and market research projects in Pakistan, especially during the COVID-19 pandemic. A total of 600 complete and valid responses were obtained. Google Forms ensured that participants could not skip questions or submit incomplete surveys. Based on G*Power 3.1 calculations, 138 responses were required to achieve a statistical power ranging from 0.95 to 0.99 with an effect size of 0.15 for the predictor model, which included five elements. The team collected four times the necessary sample size, ensuring a comprehensive analysis. No significant differences were found when comparing the first 75 responses to the last 75 responses across all variables.

Table 1.
Demographic Characteristics.

Demographic Variable	Groups	Frequency	Percentage (%)
Gender	Male	310	51.67
	Female	290	48.33
Age (in years)	18–25	245	40.83
	26–35	200	33.33
	36–45	80	13.33
	46–55	50	8.33
	Above 55	25	4.17
Education Level	Primary	20	3.33
	Secondary	85	14.17
	Graduate	230	38.33
	Postgraduate	185	30.83
	Professional Qualification	80	13.33
Residence	Rural	350	58.33
	Urban	250	41.67
FinTech Usage Experience	Less than 1 year	50	8.33
	1–3 years	120	20.00
	3–5 years	135	22.50
	Over 5 years	295	49.17
Usage Frequency	Rare	30	5.00
	Sometimes	120	20.00
	Often	180	30.00
	Always	270	45.00

4. Data Analysis and Results

The study utilized PLS-SEM through SmartPLS 4.0 to test the hypotheses in the research model, as the method supports the analysis of both mediating and moderating variables [47].

4.1. Common Method Bias (CMB) Test

Data collection through completed surveys meant that the risk of CMB was examined. According to Harman's test as described by Podsakoff et al. in 2003, none of the single factors could explain more than about 47.8% of the total variance, which is less than 50%, showing that CMB is negligible. Besides,

I performed a complete collinearity test. Since all VIF values were between 1.59 and 2.60, which are both lower than the acceptable limit of 3.3 [48], multicollinearity was not present in this model.

Table 2.
Measurement Model Assessment.

Construct	Cronbach's Alpha	Composite Reliability (CR)	AVE
Trust	0.844	0.898	0.682
Service Quality	0.812	0.872	0.648
Perceived Security	0.860	0.912	0.728
FinTech Use	0.886	0.923	0.710
Digital Financial Literacy	0.853	0.902	0.693
Financial Inclusion	0.873	0.920	0.703
Perceived Regulatory Support	0.801	0.868	0.687

The researchers checked how well the psychosocial variables measured the construct and whether they were connected to similar constructs as expected.

- The scales were found to be internally reliable, as the values of Cronbach's alpha and Composite Reliability (CR) were both 0.70 or higher, with the highest scores reaching 0.912 [47].
- By measuring the AVE values, convergent validity was established, as all constructs exceeded 0.50, with a range from 0.648 to 0.728.
- By using the Fornell-Larcker criterion, it was found that the square root of each of the AVEs was larger than any of the correlations that existed between the constructs, demonstrating that the constructs were all distinct from one another.

4.2. Structural Model Assessment

Following the assessment of the measurement model, a test was conducted on the structural model to examine the relationships between the variables as predicted in the model.

Table 3.
Hypothesis Testing.

Hypothesis	Path	β	t-value	p-value	Decision
H1	Trust → FinTech Use	0.212	3.60	0.000	Supported
H2	Service Quality → FinTech Use	0.308	5.72	0.000	Supported
H3	Perceived Security → FinTech Use	0.298	4.78	0.000	Supported
H4	FinTech Use → Financial Inclusion	0.285	6.42	0.000	Supported
H5	FinTech Use → Digital Financial Literacy	0.727	29.10	0.000	Supported
H6	Digital Financial Literacy → Financial Inclusion	0.478	10.58	0.000	Supported
H7	FinTech Use → DFL → Financial Inclusion (Mediation)	0.350	11.10	0.000	Supported
H4a	PRS × FinTech Use → Financial Inclusion (Moderation)	0.055	2.61	0.009	Supported

4.3. Model Fit and Predictive Relevance

The explanatory power of the model was assessed using R^2 values.

- FinTech Use: 53.7%
- Digital Financial Literacy: 53.2%
- Financial Inclusion: 69.5%

These results indicate strong predictive capabilities. Additionally, Q^2 values obtained from the Stone-Geisser test for predictive relevance were positive for all endogenous constructs.

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- FinTech Use ($Q^2 = 0.521$)
- Digital Financial Literacy ($Q^2 = 0.496$)
- Financial Inclusion ($Q^2 = 0.528$)

All values exceeded zero, confirming the model's strong predictive relevance [47].

Table 4.
Coefficient of Determination (R^2) and Predictive Relevance (Q^2) for Endogenous Constructs.

Construct	R^2 Value	Q^2 Value
FinTech Use	0.537	0.521
Digital Financial Literacy	0.532	0.496
Financial Inclusion	0.695	0.528

4.4. Moderation Analysis

SmartPLS analysis involved examining the interaction between Perceived Regulatory Support (PRS) and personal values. The interaction between the variables had a noticeable and significant effect on the results, as indicated by $\beta = 0.055$ and $p < 0.01$.

4.5. Interpretation

When people think that regulators are supportive, the use of FinTech is more likely to increase financial inclusion in Pakistan. That's why government measures, including Raast, the Digital Pakistan Vision, and SBP regulations, play a significant role in making users feel more secure with FinTech, which encourages financial inclusion. In Table 3 (which you add to your Word document), it can be seen that when people believe regulations are strong, increasing FinTech use leads to greater financial inclusion than at lower or moderate levels of perceived regulation support.

5. Discussion and Conclusion

This study examines the impact of digital financial literacy on financial inclusion in Pakistan, considering the growth of FinTech in the region. The results indicate that individuals with higher digital financial literacy tend to utilize digital services such as mobile banking, e-wallets, and online payment applications. Previous research suggests that understanding digital financial products helps individuals overcome barriers to accessing formal financial services. The study also emphasizes that possessing digital knowledge alone is insufficient for financial inclusion; practical use of FinTech is essential to bridge this gap. Therefore, these technologies should be promoted to ensure that more people benefit from financial services.

The study revealed that how well people are financially included is strongly affected by their education level and income when it comes to digital literacy. Based on this, while digital literacy supports everyone's finances, some specific policies are required to support those with limited income or education in accessing digital finance. More generally, if people are introduced to digital banking and FinTech, it can significantly contribute to the safety of formal financial services by linking informal and vulnerable customers to the main financial network. This study offers valuable information about digital finance in Pakistan that was not covered in earlier, mainly urban or advanced-country studies. As a result, there are clear examples of both advantages and difficulties in developing economies, making it necessary to have specifically designed responses. Although the approach was useful, some features must be acknowledged. Due to the nature of the study, we cannot be certain what influences what, and further research over time could clarify how FinTech and digital literacy evolve together. Additionally, if people self-report their usage, it could impact the results; therefore, it would be beneficial to incorporate objective data in future studies. While social groups were well-represented, the research might have overlooked the financial issues that most impact rural populations.

All in all, the study proves that digital financial literacy greatly helps achieve financial inclusion in Pakistan's FinTech landscape. Learning about financial technology and improving digital literacy helps

people from marginalized communities reduce their financial divide. For this reason, policymakers should set up wide-ranging digital literacy efforts that pay special attention to rural communities and people with lower incomes. It is important for FinTech providers to make their systems more user-friendly and educational to win users' trust and welcome them. Participation from financial services, government agencies, and NGOs may help more people recognize and rely on digital services. In the future, researchers need to study the lasting effects of digital literacy initiatives on people's finances, look into why individuals are concerned about trust and safety with new financial platforms, and survey surveys in Pakistan to make helpful FinTech programs for everyone. Increasing digital financial literacy encourages individuals and leads to an increase in the extension and sustainability of the financial sector, which helps the overall economy.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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