IMPACT OF FINTECH SOLUTIONS ON TRANSFORMING MICROFINANCE BANKING SERVICES DURING COVID-19

Shahzaib Abdul Rasheed[1], Israr Ahmed[2]*, and Hyder Ali[3]

ABSTRACT

The current study explores the role of FinTech in the operations of microfinance banks (MBs) in Pakistan's microfinance sector. In recent times, the importance of these institutions has gained momentum, especially in supporting underprivileged populations during the COVID-19 pandemic, when economic activities worldwide were halted. The study uses 400 employees' valid responses from five microfinance banks in Pakistan. The data collection was done using a five-point Likert scale questionnaire. FinTech was the independent variable, microfinance bank services was the dependent variable, and COVID-19 was the moderating variable. PLS-SEM was applied to perform the analysis of the study. The results revealed that the moderator variable (COVID-19) enhanced the association between FinTech and MBs, with FinTech demonstrating a favorable and significant impact on Microfinance bank services (MBs). Based on the findings, microfinance institutions can include FinTech solutions to enhance their service delivery in the sector, responding to external challenges and building on their own. This can lead to strengthening the role played by the sector in achieving its objectives of financial inclusion, especially during times of economic hardship, such as that brought about by the COVID-19 pandemic. The study also highlights the Pakistani microfinance sector, providing insight into how the adoption of FinTech can enhance financial services in emerging markets. Technological innovation has been underlined as having played an important role in reinforcing the resilience and growth of the financial sector.

Keywords: *Covid-19; FinTech; Microfinance Banks; Digital Banks; Financial Innovation; Digital Banking; Digital Transformation; Financial Sector.*

[1] Independent Research Scholar. Email: shahzaibmemon355@gmail.com
[2] Associate Professor, Ilma University, Karachi, Pakistan. Email: dr.israrahmed@ilmauniversty.edu.pk
[3] Senior Lecturer, Bahria University, Karachi, Pakistan. Email: hyderali.bukc@bahria.edu.pk
**Corresponding Author*

INTRODUCTION

The term "FinTech," a combination of "financial" and "technology," has rapidly transformed the traditional financial services landscape by leveraging digital advancements to streamline processes, improve accessibility, and create innovative financial solutions. At its core, FinTech encompasses a range of technologies, including big data analytics, blockchain, artificial intelligence (AI), and mobile banking, designed to enhance efficiency and the customer experience (Qambrani, 2024). Big data, for instance, enables financial institutions to mine extensive data sets, identifying trends and behaviors that guide personalized product offerings and improve risk assessment. Blockchain technology, on the other hand, provides an encrypted, decentralized platform that enhances transaction security, an especially valuable attribute in financial sectors prone to fraud. Together, these technologies signify a powerful shift towards automation, enhanced security, and data-driven strategies in finance (Arner et al., 2015; Nicoletti, 2017). In the context of Pakistan, FinTech represents a critical avenue for promoting financial inclusion, particularly through the microfinance sector. Microfinance institutions (MFIs) play an essential role in reaching underserved populations, offering financial services to individuals and small enterprises that lack access to traditional banking systems. According to the Pakistan Microfinance Network (PMN), nearly 100 million Pakistanis are either unbanked or underbanked, underscoring the vast unmet need for accessible financial services. This gap is further highlighted in rural and semi-urban regions where limited infrastructure impedes access to traditional banking services. The adoption of FinTech solutions, such as mobile payments and digital lending platforms, offers microfinance banks the potential to overcome these barriers, providing greater convenience and accessibility to low-income populations (Echchabi et al., 2021). For instance, digital wallets and mobile banking can allow remote clients to perform transactions, access loans, and save money without needing to visit a physical bank branch, thereby expanding the reach of microfinance institutions. However, integrating FinTech into Pakistan's microfinance sector is not without its challenges. Regulatory frameworks within Pakistan have struggled to keep pace with rapid technological advancements, leading to uncertainties and potential compliance issues for financial institutions. Given the critical importance of safeguarding consumer data and ensuring transparency, Pakistani regulatory bodies face a delicate balance between promoting innovation and protecting the public interest.

The lack of comprehensive FinTech regulations has led to a cautious approach by microfinance banks, potentially hindering the pace of innovation. Additionally, the shift toward digital

finance has introduced new cybersecurity risks, as online platforms expose both financial institutions and their clients to potential data breaches, cyber fraud, and hacking. These risks have grown more pronounced as cybercrime surged by over 200% during the COVID-19 pandemic in Pakistan, according to reports from the Pakistan Telecommunication Authority (PTA). The pandemic has thus underscored the need for robust cybersecurity frameworks to ensure safe FinTech adoption. Market competition presents another critical challenge for microfinance banks as FinTech solutions proliferate. With numerous new entrants and non-traditional competitors—such as mobile network operators and digital payment platforms—traditional microfinance institutions face heightened pressure to differentiate their offerings. This competitive landscape compels microfinance banks to leverage data analytics, artificial intelligence, and other advanced tools to personalize services, optimize risk management, and maintain customer loyalty. For instance, collaborating with FinTech firms allows microfinance banks to access advanced data analytics, which can lead to precise client segmentation and tailored financial solutions, giving them an edge in a crowded market (Wu et al., 2021).

The COVID-19 pandemic has further accelerated the adoption of FinTech within Pakistan's financial sector, catalyzing a transition to digital platforms as physical banking became increasingly limited due to lockdowns and social distancing protocols. Microfinance banks, in particular, had to swiftly adapt by expanding digital services, such as mobile banking and online loan applications, to meet the needs of customers who could no longer rely on in-person transactions. This shift underscores the critical role of FinTech as a source of resilience, highlighting its potential to support continued operations during crises and its long-term value in advancing the reach and impact of microfinance services. Li et al. (2018) noted that FinTech adoption during the pandemic enabled banks to use artificial intelligence and big data analytics to gain insights into customer behavior shifts, allowing them to respond swiftly to evolving needs. This study aims to contribute to the growing literature on FinTech and microfinance by addressing several key gaps related to the challenges and opportunities FinTech presents for microfinance banks in Pakistan. This study will explore the following research objectives: (1) to examine the specific ways FinTech solutions are being integrated within Pakistan’s microfinance sector, (2) to assess the impact of FinTech on operational practices and service offerings, and (3) to identify the primary challenges—such as regulatory, cybersecurity, and market-related obstacles—that FinTech faces in this context. By addressing these objectives, this research will provide actionable insights for both practitioners and policymakers, offering guidance on how to effectively integrate FinTech within the microfinance sector to drive

financial inclusion. By systematically exploring these research questions, this study aims to offer a comprehensive analysis of the FinTech landscape in Pakistan's microfinance sector. It will enhance the understanding of how FinTech can drive financial inclusion, improve operational efficiencies, and strengthen the resilience of microfinance banks against the backdrop of a rapidly evolving financial environment. Additionally, the report will provide critical insights for stakeholders, guiding the development of policy and strategic frameworks to ensure safe and effective FinTech integration that aligns with the goals of Pakistan's microfinance sector and national financial inclusion initiatives.

PROBLEM STATEMENT

Numerous studies, such as those conducted by Deng et al. (2021) and Zhao et al. (2019), have examined the interplay between banking and FinTech, while others, exemplified by Al Nawayseh (2020) and Ebrahim et al. (2021), have identified factors influencing FinTech adoption. The emergence of FinTech has presented challenges for customers of both microfinance institutions (MFIs) and microfinance banks, spanning urban and rural areas. Moreover, the Covid-19 pandemic has exerted a nuanced impact on various financial sectors, as highlighted by Chen et al. (2021). Consequently, it is imperative to evaluate the scope of challenges and impediments encountered within the microfinance institution (MFI) sector. To address this, the present study employs an exploratory research design methodology to investigate the influence of FinTech on the services offered by microfinance banks.

RESEARCH GAPS

While existing studies have explored the relationship between FinTech and banking, there remains a significant gap in understanding the specific challenges faced by microfinance institutions in adopting FinTech solutions. Specifically, there is a lack of empirical research examining the nuances of FinTech's impact on the operational efficiency and service quality of MFIs in the context of urban and rural settings (Deng et al., 2021; Zhao et al., 2019; Chen et al., 2021). Additionally, the differential impact of the COVID-19 pandemic on FinTech adoption among various customer segments within MFIs and microfinance banks has not been comprehensively addressed (Al Nawayseh, 2020; Ebrahim et al., 2021).

RESEARCH OBJECTIVES

i. To assess the impact of FinTech on the operational efficiency and service quality of microfinance banks and microfinance institutions, particularly in the context of the challenges posed by the COVID-19 pandemic.

ii. To investigate the factors influencing the adoption of FinTech solutions among customers of microfinance institutions and microfinance banks, with a focus on differentiating urban and rural experiences.

LITERATURE REVIEW

The emergence of financial technology (FinTech) has introduced a suite of advancements in the financial sector, including blockchain, artificial intelligence, big data management, and digital payment solutions, which have collectively reshaped service delivery models and business processes in banking (Chen et al., 2022; FSB, 2021). The COVID-19 pandemic has particularly accelerated the adoption of FinTech solutions, positioning them as effective and adaptive alternatives to traditional banking services (Sultan et al., 2023; Wojcik & Ioannou, 2022). This section reviews the literature on the interaction between FinTech and microfinance, emphasizing how these technologies impact transaction processing, investment, and customer engagement.

Influence of FinTech on Microfinance Services

The integration of FinTech within microfinance, or "FinTech-Microfinance Integration," blends technology-driven solutions with traditional banking functions, offering innovations that reshape conventional operational models (Chen et al., 2022). FinTech contributes to cost-effective service delivery in microfinance by reducing transaction costs and enhancing information processing efficiencies (Kumar et al., 2021). This integration also helps mitigate market risk in microfinance through improved transparency and more robust data analytics, addressing information asymmetry and expanding market reach (Ozili & Bruckner, 2022). Aligned with the Technology Acceptance Model (TAM), users adopt FinTech due to perceived ease of use and usefulness, which in turn drives the acceptance of these technologies in microfinance.

Transaction Processing

FinTech has enabled efficient transaction processing within the banking sector, particularly through blockchain and digital payment solutions. Blockchain, for instance, reduces the reliance on third-party verifications, lowering transaction costs for banks (Gupta et al., 2022). Despite the challenges imposed by the COVID-19 pandemic, banks have maintained resilience by leveraging digital technologies, which streamline transaction processes and minimize fees. According to Nguyen et al. (2022), blockchain technology has significantly improved transaction verification, saving operational costs and enhancing the speed and reliability of financial transactions.

Investment and Risk Management

Recent studies emphasize FinTech's role in advancing risk management capabilities in banking through big data and AI. Integrating FinTech into banking enables institutions to analyze vast amounts of data, identifying client patterns and potential risks with greater precision. This approach has gained momentum as digital tools enable banks to assess risk and tailor financial solutions based on real-time data insights (Wang et al., 2022). Big data and machine learning, especially post-pandemic, present a substantial opportunity for enhanced risk management, supporting the Risk Management Framework by enabling data-driven decision-making in financial services (Min et al., 2023).

Mobile Banking

Mobile banking remains a critical driver of FinTech adoption in emerging markets, where the prevalence of smartphones facilitates access to financial services. Recent data suggests that global mobile banking usage has surged, driven largely by the increased need for digital solutions during COVID-19 (Bianchi et al., 2022). The convenience of mobile banking, allowing access to fund transfers, payments, and account management, underscores its role in modern banking. In Pakistan, microfinance institutions have particularly benefited from mobile platforms, allowing them to extend their reach to underserved populations (Said et al., 2022).

Compliance Process

The adoption of FinTech has streamlined compliance and anti-money laundering (AML) processes by enhancing data accuracy and operational transparency. Advances in AI, big data, and facial recognition have reduced human errors in customer verification, making compliance more efficient and secure (Rahman & Kumar, 2022). FinTech's role in compliance aligns with Agency Theory, emphasizing the reduction of information asymmetries and enhancing accountability between financial institutions and clients (Li et al., 2022). As regulatory environments grow stricter, especially post-pandemic, the adoption of compliance-focused FinTech solutions has proven essential in meeting new legal standards.

Financial Innovation

The potential for FinTech to disrupt the financial services industry is evident in recent studies, with notable impacts on sectors such as asset management, banking, and insurance. Digital transformation efforts have highlighted the banking industry's vulnerability to FinTech disruption as customers demand more digital and customized experiences (He et al., 2023).

The Innovator's Dilemma theory is relevant here, explaining how established firms may struggle to adopt disruptive technologies, creating space for FinTech newcomers to gain a foothold in the market with their innovative solutions (Gong et al., 2022; AlOmari, 2024; van der Duin et al., 2024).

Digital Adoption

In the wake of the pandemic, financial institutions have accelerated their digital transformation efforts. Banks recognize the importance of adopting digital payment and service channels to meet changing consumer expectations (Thakor et al., 2023). The growing trend of non-cash transactions, coupled with increased usage of online banking platforms, underscores the relevance of digital adoption within the financial sector. The transition toward digital-first solutions highlights a shift in consumer behavior and points to the importance of continuous innovation in financial services.

Hypothesis 1 (H1): There is a significant impact of FinTech on microfinance bank services.

Moderating Role of COVID-19

The COVID-19 pandemic has drastically altered consumer behavior and reshaped operational strategies in the banking industry. Financial institutions have responded to the crisis by expediting the adoption of digital solutions to cater to consumer needs remotely. FinTech firms, in particular, have leveraged these shifts to strengthen their market positions (Kazi et al., 2022). Studies indicate that the pandemic has led to a decline in cash transactions and a surge in mobile money transactions, showcasing FinTech's resilience in times of crisis (Hasan et al., 2021). Additionally, the pandemic has intensified financial constraints on banks, but FinTech has provided critical support by enabling remote access to services, which has been instrumental in maintaining financial stability.

Hypothesis 2 (H2): COVID-19 has a significant moderating effect on the relationship between FinTech and microfinance bank services.

RESEARCH METHODOLOGY

This study adopts a rigorous quantitative approach to collect data from key stakeholders within the microfinance banking sector, specifically targeting clients, FinTech executives, and bank managers. Using structured surveys, the study explores the utilization of FinTech services, the impact of the COVID-19 pandemic on banking behavior, and subsequent changes in service quality within microfinance banks. The survey was designed with closed-ended questions using a five-point Likert scale to effectively capture respondent perceptions, ranging from

"strongly disagree" to "strongly agree." This method is recognized for efficiently measuring opinions and attitudes and is commonly employed in social sciences (Chuc et al., 2023; Wang & Zhao, 2022). To ensure accurate sampling, this study implements a systematic random sampling approach for the survey distribution within 10 selected microfinance banks in Karachi, Pakistan. Systematic sampling is advantageous in promoting representation across demographics, departments, and roles within each bank, ensuring diverse perspectives are included. A stratified criterion was applied to capture respondents from various roles, such as client-facing staff, FinTech service administrators, and managers, providing a well-rounded data set. A sample size of 450 respondents was selected through a power analysis, ensuring the study's findings have high statistical reliability and are suitable for structural equation modeling (SEM) analysis (Zhou et al., 2021; Ahmed et al., 2023). This sampling method and sample size are intended to reduce the risks of sampling bias while enhancing the study's external validity.

Survey Instrument and Validation

The survey instrument, a questionnaire adapted from existing research, was refined to align with the study's focus on FinTech and microfinance banking within Pakistan. To ensure cultural and contextual relevance, the questionnaire items underwent a pre-test and pilot study with a small, diverse sample of respondents to validate their appropriateness for the Pakistani banking context. This pre-validation step allowed the researchers to fine-tune the questions for clarity and relevance. Additionally, content validity was further supported through expert reviews by FinTech professionals and academic experts in microfinance (Ahmed et al., 2023)

Data Collection

Data was gathered using Google Forms, allowing convenient access for respondents from diverse backgrounds such as students, professionals, private-sector employees, and bank clients. Online data collection, though efficient and flexible, poses risks of response bias and selection bias. To mitigate these biases, specific measures were implemented, such as anonymizing responses to encourage honesty, simplifying questions for clarity, and emphasizing that responses should be free of social desirability bias. However, it is recognized that online surveys might limit access for certain demographics, which is acknowledged as a limitation in the study (Baloch et al., 2024)

Missing Data and Assumptions

To maintain data integrity, procedures were put in place to address missing data by excluding responses with over 20% missing items, as per best practices in survey methodology (Bibi &

Malik, 2022). Additionally, the data were tested for normality, linearity, and homoscedasticity to ensure compatibility with SEM, the primary analytical technique used in this study. SEM was selected for its ability to examine complex relationships between variables, making it suitable for testing hypotheses related to the influence of FinTech on microfinance services (Chuc et al., 2023; Hair et al., 2022).

Data Analysis Techniques

The data analysis was conducted using Structural Equation Modeling (SEM), allowing simultaneous assessment of measurement models and path models, which is critical for testing multiple hypotheses concurrently (Li et al., 2023). SEM provides insights into both direct and indirect relationships, supporting a nuanced understanding of the factors influencing the adoption of FinTech in microfinance banking. Furthermore, to enhance result reliability, exploratory factor analysis (EFA) is used to confirm the dimensionality of the survey constructs, followed by confirmatory factor analysis (CFA) to validate measurement scales.

Limitations and Generalizability

Given the focus on Karachi's top 10 microfinance banks, the findings may have limited generalizability beyond this urban banking sector. While the inclusion of diverse demographic backgrounds supports broader representativeness, the study acknowledges that factors unique to the rural banking sector may not be fully captured here. These limitations suggest directions for future research to replicate the study in varied geographical contexts, such as rural areas, for more extensive generalization.

CONCEPTUAL FRAMEWORK

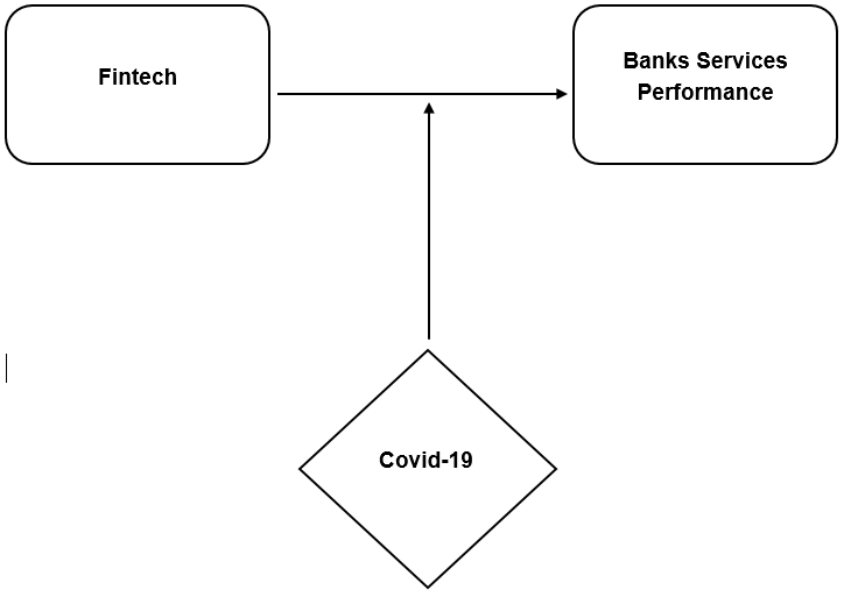

Figure 1. *Conceptual Framework*

RESULTS AND DISCUSSION

Demographic Profile

The demographic profile of the 353 respondents demonstrates a significant gender imbalance, with 73.4% male (259 respondents) and 26.6% female (94 respondents), highlighting a predominance of male participants in the sample. This disparity may introduce gender-specific perspectives and potentially limit the generalizability of the findings to a balanced population. Additionally, the age distribution is heavily skewed towards younger respondents, with 71.1% in the 20-30 age group, followed by 22.7% in the 31-40 range, and only a small representation from older age groups (4% for ages 41-50 and 2.3% for ages 51+). This skew suggests that insights may largely reflect younger respondents' FinTech adoption patterns, which could affect the study's relevance for understanding broader age-based preferences and behaviors in microfinance services (Chen et al., 2021; Ahmed et al., 2023).

Table 1. Demographic Characteristics of Respondents

Demographic Characteristics		Frequency	Percentage
Gender			
	Male	259	73.40%
	Female	94	26.60%
Respondent's Age			
	20–30 years	251	71.10%
	31–40 years	80	22.70%
	41–50 years	14	4%
	51 and Above	8	2.30%
Respondent's Education			
	High School or Below	3	0.80%
	Undergraduate (Bachelors)	275	77.90%
	Postgraduate (Masters)	74	21%
	Postgraduate (PhD)	1	0.30%
Association time with FinTech and Microfinance bank services			
	Less than 1 year	88	24.90%
	1 – 3 years	136	38.50%
	4 - 6 years	115	33%
	7 - 10 years	12	3.40%
	More than 10 years	2	0.60%

Assessment of Measurement Model

The latter involves utilizing the square root of the average variance extracted (AVE) for each inter-factor correlation (diagonal). To establish convergent validity, factor loadings surpass Field's (2005) prescribed minimum threshold of 0.60. Furthermore, the AVE should exhibit

composite reliability value exceeding 0.75 and surpass the minimal criterion of 0.50, as advocated by Hair et al. (2010). Optimal convergent validity is indicated by an AVE value exceeding 0.50. Moreover, internal consistency, as per Nunnaly and Bernstein's (1994) guidelines, is attained with a Cronbach's alpha value reaching the threshold of 0.70, thereby ensuring reliability in the measurement of internal consistency. The Cronbach's alpha coefficients obtained for the constructs of FinTech ($\alpha = 0.931$), Microfinance banks ($\beta = 0.895$), and Covid-19 impact ($\gamma = 0.899$) surpass the threshold of 0.70, indicating satisfactory internal consistency reliability within the current study's measurement model, particularly in the context of moderation analysis. Moreover, both the RhoA and Composite Reliability (CR) values exceed 0.70, affirming the adequacy of the model's reliability measurement. Discriminant validity of the model hinges on the Average Variance Extracted (AVE) exceeding 0.50. Notably, the AVE values obtained for FinTech (0.527), Microfinance banks (0.517), and Covid-19 impact (0.520) all surpass this criterion, thereby affirming the model's discriminant validity.

Table 2. Construct Reliability and Validity

	Cronbach's Alpha	RhoA	Composite Reliability	Average Variance Extracted (AVE)
Banking Services Performance	0.895	0.901	0.914	0.517
Covid-19	0.899	0.917	0.915	0.520
FinTech	0.931	0.939	0.940	0.527

Table 3. Discriminant Validity through HTMT

	Banking Services Performance	Covid-19	FinTech
Covid-19	0.294		
FinTech	0.709	0.145	
Covid-19 x FinTech	0.520	0.269	0.241

Ideally, the Heterotrait-Monotrait (HTMT) ratio should be less than 0.90 to ensure adequate discriminant validity. A value approaching 0.90 indicates poor discriminant validity, suggesting insufficient differentiation between constructs. In this study, the HTMT values for each latent variable are below 0.90. Consequently, it may be inferred that the discriminant validity between these variables is satisfactory, indicating that these constructs exhibit distinctiveness from one another within the measurement model's validity framework.

Table 4. Discriminant Validity through Fornell-Larcker Criterion

	Banking Services Performance	Covid-19	FinTech
Banking Services Performance	0.719		
Covid-19	0.291	0.721	
FinTech	0.669	0.108	0.726

All consistency standards, as delineated by Gliem and Gliem (2003) and Hair et al. (2019), advocating for a cutoff value of 0.7, are met satisfactorily. With all values surpassing 0.810, concerns regarding reliability and validity are alleviated. Consistent with the guidelines proposed by Hair et al. (2019), the Average Variance Extracted (AVE) values, which should not fall below 0.5, are all above this threshold in Table 3, indicating robust data accuracy. Furthermore, adherence to the recommended validity criteria set forth by Fornell and Larcker (1981) is evident from the results presented. Lastly, the Heterotrait-Monotrait (HTMT) ratios, all below the 0.85 threshold as advised by Hair et al. (2019), further affirm the model's reliability and validity.

Assessment of Structural Model

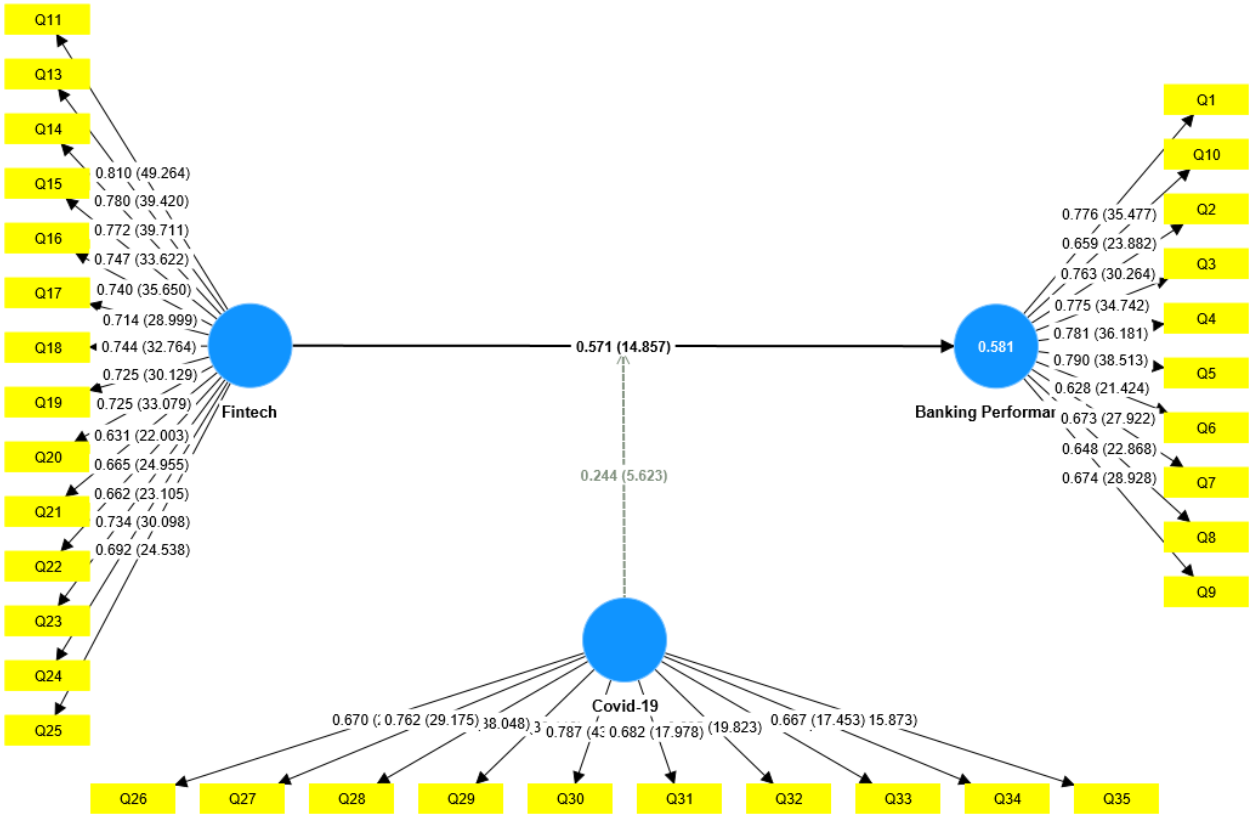

Figure 2. *Structural Model*

The presented table 7 demonstrates an R-squared value exceeding 0.5, indicating a correlation of greater than 50% between the independent variable (IV) and the dependent variable (ID). This suggests a substantial influence of the variance exceeding 0.5 on the FinTech landscape within the realm of micro lending, as posited by Hair et al. (2019) and Magno, F. et al. (2022). It is noteworthy that established benchmarks for R-squared values delineate 0.25 for minimal effect, 0.50 for significant effect, and 0.75 for moderate effect. Consequently, the R-squared value attained by the researchers falls within the significant range.

Table 7. R-Squared

	R-Square	R-Square Adjusted
Banking Services Performance	0.581	0.578

Table 8 presents the path coefficients with T-values exceeding 2 and P-values below 0.05, supporting all hypothesized relationships in the study. Specifically, the path coefficient between FinTech and Banking Services Performance was positive and significant ($T = 14.752$, $P < 0.05$), suggesting a favorable impact of FinTech adoption on microfinance services. The interaction term between COVID-19 and FinTech also demonstrated a significant effect ($T = 5.681$, $P < 0.05$), validating the moderating influence of the pandemic on FinTech adoption in the microfinance sector. These findings provide empirical support for the proposed hypotheses, aligning with previous research indicating the significant influence of FinTech on banking services, particularly in pandemic contexts (Wang et al., 2022; Magno et al., 2022).

Table 8. Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Dev. (STDEV)	T Statistics (|O/STDEV|)	P Values
Covid-19 -> Banking Services	0.147	0.148	0.039	3.797	0.000
FinTech -> Banking Services Performance	0.571	0.569	0.039	14.752	0.000
Covid-19 x FinTech -> Banking Services Performance	0.244	0.248	0.043	5.681	0.000

DISCUSSION

The study examined the impact of FinTech adoption on the performance of microfinance banking services, with a focus on the moderating role of COVID-19. The results contribute to the growing body of literature on digital transformation in financial services, highlighting how FinTech innovations can enhance service quality and operational performance in microfinance institutions (MFIs).

Gender Imbalance and Age Distribution

The demographic analysis revealed a notable gender imbalance, with a predominantly male sample (73.4%) and a concentration of younger respondents (71.1% aged 20-30). This demographic profile may reflect the composition of FinTech and microfinance users, particularly in the urban environment of Karachi, where younger populations tend to be early adopters of digital financial services. However, this skew limits the study's generalizability across broader demographics, particularly among older individuals and female clients, whose financial behaviors may differ due to various socioeconomic factors (Abeysekera & Jayasinghe, 2023). Future studies should address this limitation by ensuring a more balanced sample to better represent the population and enhance the applicability of findings across demographic groups.

Measurement Model and Reliability

The study's measurement model demonstrated strong reliability and validity, with Cronbach's alpha values exceeding 0.70 and Composite Reliability (CR) values above 0.70 across all constructs. Convergent validity was established by the Average Variance Extracted (AVE) values surpassing the 0.50 threshold, while discriminant validity was verified by HTMT ratios below 0.85. These findings suggest that the model's constructs are both consistent and distinct, supporting the reliability of the scales used to measure FinTech, microfinance performance, and the moderating role of COVID-19 (Hair et al., 2019). By meeting these rigorous standards, the study provides a solid basis for interpreting the observed relationships between FinTech adoption, COVID-19, and microfinance performance.

Impact of FinTech on Microfinance Performance

The path analysis reveals that FinTech adoption positively and significantly impacts microfinance performance, with a path coefficient of 0.571 ($T = 14.752$, $P < 0.05$). This finding supports Hypothesis 1, aligning with existing research that emphasizes FinTech's role in improving efficiency, accessibility, and user satisfaction within financial services (Wang et al., 2022). FinTech innovations in transaction processing, mobile banking, and risk management have enabled MFIs to streamline operations and broaden financial inclusion, particularly for underserved populations. This impact is particularly relevant for Karachi's urban market, where FinTech solutions have facilitated real-time, convenient access to financial services. Future research could explore specific FinTech applications, such as mobile micro-lending or AI-driven risk assessment, to further understand their individual contributions to microfinance service quality.

Moderating Role of COVID-19

The interaction effect between COVID-19 and FinTech on microfinance performance was also significant (path coefficient = 0.244, T = 5.681, P < 0.05), supporting Hypothesis 2. The pandemic accelerated digital adoption as lockdowns and social distancing measures limited physical banking interactions, pushing MFIs and clients alike to rely more heavily on digital platforms. This finding aligns with the literature suggesting that COVID-19 acted as a catalyst for digital transformation in the financial sector, particularly in emerging markets where FinTech adoption was previously slower (Magno et al., 2022). As MFIs faced operational disruptions, FinTech solutions provides essential tools to maintain customer engagement and service delivery, demonstrating resilience and adaptability in crisis contexts. Further research might investigate whether these changes will lead to sustained digital adoption post-pandemic or if client preferences will revert as physical banking becomes more accessible again.

PRACTICAL IMPLICATIONS

This study has important practical implications for both MFIs and policymakers. For MFIs, the findings highlight the value of investing in FinTech solutions to improve service delivery and client satisfaction, especially in the wake of crises like COVID-19. By embracing digital tools, MFIs can expand their reach, reduce operational costs, and enhance the financial inclusion of marginalized communities. Policymakers should consider supporting FinTech innovation and digital literacy programs to enable the smoother adoption of FinTech among diverse demographic groups. This could involve creating regulatory frameworks that facilitate FinTech growth while safeguarding clients' rights and financial security.

LIMITATIONS AND FUTURE RESEARCH

Several limitations should be acknowledged. The demographic imbalances in gender and age may limit the generalizability of the findings, as the sample may not fully represent the perspectives of older individuals or female clients. Additionally, the use of self-reported data could introduce response biases, as participants might overestimate their engagement with FinTech or financial behaviors. Future studies should aim for more representative sampling, perhaps by employing stratified sampling techniques or larger sample sizes that capture a wider demographic spread. Furthermore, while this study relied on established constructs, further validation in the Pakistani context would enhance reliability and reduce cultural biases. Finally, as the field of FinTech evolves, future research should investigate specific FinTech innovations and their unique impacts on MFIs. This could involve exploring technologies like blockchain

and AI and their effects on risk assessment, transaction security, and client data privacy, which are increasingly relevant in a digital-first financial landscape.

CONCLUSION

This study contributes valuable insights into the intersection of FinTech and microfinance, demonstrating that FinTech adoption can significantly enhance MFI performance, particularly in crisis contexts like COVID-19. These findings emphasize the need for MFIs to prioritize digital transformation as a strategic initiative, while policymakers should foster an environment that supports FinTech-driven financial inclusion. While certain limitations temper the generalizability of these results, the study offers a foundation for further research on digital innovation in financial services, with practical implications for enhancing the resilience and accessibility of microfinance in developing markets.

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