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The Influence of Financial Technologies (Fintech) on Modern Banking: Analyzing Barriers, Cybersecurity, Regulatory Frameworks, and Their Effects on Financial Inclusion and Customer Experience in Pakistan

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Abstract
This study investigates the impact of financial technologies (FinTech) on modern banking, focusing on barriers to adoption, cybersecurity concerns, regulatory frameworks, and their influence on financial inclusion and customer experience in Bannu, Khyber Pakhtunkhwa, Pakistan. Utilizing a sample of 200 banking employees and FinTech users, the research employs descriptive statistics, reliability analysis, correlation analysis, and hypothesis testing to explore the relationships between these variables. The results demonstrate a significant positive impact of regulatory frameworks, cybersecurity concerns, and barriers on the adoption of FinTech innovations. Furthermore, FinTech innovations were found to significantly enhance both financial inclusion (Beta = 0.50, $p < 0.01$) and customer experience (Beta = 0.55, $p < 0.01$), highlighting their potential to improve access to banking services in underdeveloped areas. The findings suggest that while barriers such as limited awareness and cybersecurity risks exist, the benefits of FinTech—particularly in terms of accessibility and customer satisfaction—are substantial. Policymakers and financial institutions are encouraged to develop strategies that address these barriers and enhance security measures to facilitate greater FinTech adoption. These results align with prior studies on the transformative role of FinTech in improving financial services, especially in under developed regions.

Keywords; Fintech, Cybersecurity, Regulatory frameworks, Cybersecurity risks.

Introduction

The advent of financial technologies, or FinTech, has significantly transformed the banking industry. Traditionally, banks offered limited products such as savings accounts, loans, and investment options through physical branches, with face-to-face communication being the norm (Shah et al., 2022). However, the rise of technology has allowed for faster, more efficient, and personalized services. One key development is the proliferation of mobile banking platforms, which have reduced the need for physical branches and made almost every banking service

available digitally (Khan et al., 2022). FinTech has also introduced innovative products and services, such as peer-to-peer lending platforms, robo-advisors for wealth management, and blockchain-based solutions for secure and transparent transactions. These innovations have disrupted traditional banking by offering competitive services at lower costs, bypassing intermediaries, and reducing transaction fees. Banks are now competing with FinTech startups and technology giants, offering innovative solutions and business models (Kumari, & Devi, 2022).
Another significant impact of FinTech on modern banking is the rise of data analytics and artificial intelligence (AI). Banks now have access to vast amounts of customer data, which can be leveraged to offer more personalized products and services. AI and machine learning algorithms are being used to analyze this data, allowing banks to predict customer behavior, assess credit risk more accurately, and even detect fraudulent activities in real-time (Liang, 2023). This data-driven approach has improved operational efficiency and enhanced customer satisfaction by offering tailored solutions that meet individual needs and preferences.
However, the integration of FinTech into the banking sector has also introduced new challenges. Cybersecurity has become a major concern as banks store and process an increasing amount of sensitive information digitally. The risk of data breaches and hacking incidents is higher than ever, necessitating heavy investment in cybersecurity measures. Additionally, the rise of FinTech has raised questions about regulation and oversight (Wang et al., 2024). Traditional banks are heavily regulated, but many FinTech startups operate in a more flexible regulatory environment, creating potential risks for consumers and the broader financial system.
Regulators worldwide are working to create frameworks that ensure the safety and security of financial transactions while promoting innovation in the sector. Open banking regulations in many regions are designed to foster competition and innovation by allowing third-party providers to access customer data subject to consent (González Páramo, 2017).
In short, the impact of FinTech on modern banking has been profound and far-reaching. While traditional banks continue to play a significant role in the financial system, they must evolve rapidly to keep pace with technological advancements and changing consumer expectations. The successful integration of technology into banking will depend on financial institutions' ability to balance innovation with risk management while meeting the evolving needs of their customers.
The emergence of the digitalized currencies has brought about a serious debate about how these CBDCs are affecting the conventional financial system. As is known that the CBDCs have a very minimal dependence on the bank's deposits, they are a threat to the current financial banking system, although they may have a possible positive impact on the efficiency and effectiveness of the banking and financial system. The incorporation or competition of the fintech business with the CBDCs system may cause their ability to innovate to be limited. Though there are still questions over the ability of the CBDCs as how they might work and perform in a digital financial sector, it is also expected that they may benefit the central's banks in executing financial policies. CBDCs also may have a better impact on the individuals whom they are directed at by providing better financial accessibility, fast transactions, and enhanced security. Thus, the study aims at providing insightful information about the future of the CBDCs and their impact on the world financial system, as well as to fill the research gap on this specific issue.

Objectives of the Study

1. To identify the primary barriers hindering the adoption of FinTech in Bannu, Khyber Pakhtunkhwa.
2. To assess the impact of low FinTech adoption on financial inclusion and accessibility to banking services in Bannu.

3. To explore how FinTech innovations can enhance the customer experience and drive personalized banking services in the region.
4. To evaluate the significance of cybersecurity and risk management concerns among consumers and financial institutions in Bannu.
5. To propose recommendations for adapting regulatory frameworks to encourage and support FinTech adoption in the Bannu region.

Research Questions

1. What are the key barriers to the adoption of financial technologies in the Bannu region of Khyber Pakhtunkhwa, Pakistan?
2. How has the limited adoption of FinTech affected financial inclusion in Bannu, particularly for underserved communities?
3. In what ways can FinTech innovations improve the customer experience and personalization of banking services in Bannu?
4. What is the role of cybersecurity and risk management in influencing the perception and use of FinTech in the Bannu area?
5. How can regulatory frameworks in Pakistan be adapted to better support the integration of FinTech in Bannu's banking sector.

Literature Review

Theoretical Framework

The literature on financial technologies and their impact on modern banking is extensive, covering multiple dimensions of this evolving field. In this review, we will focus on five key variables that have emerged from the literature, which help to explain the profound effects of financial technologies (FinTech) on the banking sector. These variables include: 1) Digital Transformation, 2) Customer Experience and Personalization, 3) Cybersecurity and Risk Management, 4) Financial Inclusion, and 5) Regulatory Challenges. The discussion of each variable was supported by insights from leading studies and reports, offering a comprehensive analysis of the existing literature on this subject.

Digital Transformation

Digital transformation has been a major driver of change in modern banking. Traditional banks, once reliant on brick-and-mortar branches, have undergone significant digital overhauls to remain competitive. The literature indicates that banks' investments in digital infrastructure and FinTech have dramatically increased in recent years, leading to improved efficiencies and the creation of new business models (González Páramo, 2017).

One of the most critical aspects of digital transformation is the adoption of mobile and online banking platforms. According to PWC (2019), more than 80% of banks have either already implemented or are in the process of implementing digital banking initiatives. These initiatives enable customers to access banking services from any location, conduct transactions 24/7, and reduce the dependency on physical branches. Vives (2019) highlights how banks are also utilizing cloud-based solutions and artificial intelligence (AI) to optimize their operations and enhance the delivery of services. These technologies allow banks to reduce costs, streamline internal processes, and improve customer service, thereby creating a more agile and responsive banking environment.

AI has played an integral role in the digital transformation of banking. According to a report by McKinsey (2021), AI has enabled banks to automate many routine tasks, such as customer support and fraud detection, freeing up human resources for more complex decision-making. Algorithms powered by AI and machine learning are now capable of analyzing vast amounts of

customer data to predict behaviors and needs, making banking not only more efficient but also highly tailored to individual clients.

The COVID-19 pandemic further accelerated the trend toward digital transformation. With widespread lockdowns and restrictions, banks were forced to innovate rapidly to meet the surge in demand for online services. Research by Deloitte (2020) reveals that digital banking surged in usage by 72% during the pandemic, signaling that customers have become increasingly comfortable with accessing services through digital channels.

Customer Experience and Personalization

One of the most visible impacts of FinTech on modern banking is the transformation of customer experience, a variable that has garnered substantial attention in the literature. Historically, banks were often seen as slow, impersonal, and rigid. However, the integration of digital technologies has allowed financial institutions to provide more personalized and responsive services, creating a more customer-centric model of banking (Wang, Asif, Shahzad, & Ashfaq, 2024).

Personalization is enabled primarily through data analytics and AI, both of which allow banks to tailor services and products to meet the unique needs of individual customers. Research by Gomber et al. (2017) shows that by leveraging customer data, banks can create customized offers, provide relevant financial advice, and predict future financial needs. This represents a fundamental shift in how banks engage with their customers, making the customer experience a critical differentiator in the competitive banking landscape (Liang, 2023).

Furthermore, mobile banking applications have revolutionized the way customers interact with their banks. Customers can now conduct transactions, pay bills, and monitor their accounts without ever setting foot in a branch. According to a study by Capgemini (2020), over 70% of customers prefer using mobile apps to access banking services due to the convenience and efficiency they provide. As a result, banks have had to invest heavily in developing user-friendly, secure, and feature-rich applications to keep up with customer expectations.

A significant element of personalization is the rise of robo-advisors—digital platforms that provide automated, algorithm-driven financial planning services. These platforms have democratized access to wealth management by offering low-cost investment advice to a broader audience. The study by Sironi (2016) highlights how robo-advisors have transformed the wealth management industry by making it more accessible and affordable, which, in turn, has forced traditional banks to innovate their own wealth management services.

Customer experience is not solely about convenience and personalization; it also involves the reliability and security of services. In today's fast-paced, always-connected world, customers expect seamless and secure transactions. Therefore, banks have had to enhance their cybersecurity protocols and ensure that their digital platforms offer uninterrupted service to avoid losing customer trust.

Cybersecurity and Risk Management

As banks and financial institutions increasingly rely on digital technologies, cybersecurity has become a critical concern. The literature consistently emphasizes the heightened risk of cyberattacks and the corresponding need for robust cybersecurity measures. As FinTech evolves, so do the sophistication and frequency of cyber threats, leading to an evolving landscape of risk management (Liang, 2023).

Many studies have underscored the importance of cybersecurity in maintaining the trust of customers and regulators alike. For example, a report by the World Economic Forum (2018) highlights that cybersecurity threats pose one of the most significant risks to financial stability, as banks handle sensitive data, including customer financial information and transactional data.

Cybersecurity breaches not only result in financial losses but also erode customer trust, which is vital to the sustainability of financial institutions (González Páramo, 2017; Wang et al., 2024).

Research has shown that banks are particularly vulnerable to cyberattacks due to the vast amounts of data they hold. A study by Accenture (2021) found that the average cost of cybercrime for financial services companies increased by over 40% between 2018 and 2021, as hackers became more sophisticated and targeted. The report recommends that banks invest in advanced cybersecurity technologies, such as encryption, multi-factor authentication, and blockchain, to safeguard their operations against potential attacks.

Blockchain, in particular, is frequently cited in the literature as a potential solution for enhancing cybersecurity in banking. According to research by Mougayar (2016), blockchain technology can provide an immutable and transparent record of transactions, making it more difficult for hackers to manipulate data. This technology has already been implemented in various aspects of banking, from international payments to regulatory compliance, offering increased security and efficiency.

Risk management also extends to the regulatory compliance obligations banks must meet. With the introduction of digital banking services, regulators have imposed stringent guidelines to ensure data protection and the integrity of financial transactions. Many banks have adopted "RegTech" solutions—technologies that help institutions meet regulatory compliance requirements through automation. This is critical as it reduces the burden on banks to manually ensure compliance, allowing them to focus on innovation and service delivery. Research by Arner, Barberis, and Buckley (2017) highlights how RegTech is changing the regulatory landscape, making compliance more manageable while mitigating risks.

Financial Inclusion

The role of FinTech in enhancing financial inclusion has been one of the most promising developments in modern banking. Historically, a significant portion of the global population, particularly in developing countries, has been excluded from traditional banking services due to various factors, including geographic constraints, lack of access to financial infrastructure, and high fees. However, financial technologies are increasingly bridging this gap by offering accessible and affordable banking services to underserved populations (Wang et al., 2024).

Mobile banking has emerged as a key enabler of financial inclusion, particularly in regions where traditional banking infrastructure is lacking. For instance, M-Pesa, a mobile payment system launched in Kenya, is widely cited in the literature as a prime example of how FinTech can foster financial inclusion. According to a study by Jack and Suri (2014), M-Pesa has enabled millions of unbanked individuals in Kenya to access financial services through their mobile phones, significantly improving their economic opportunities and financial well-being. The success of M-Pesa has inspired similar innovations across Africa, Asia, and Latin America, where mobile banking has become a lifeline for the unbanked.

Digital lending platforms have also contributed to financial inclusion by offering credit to individuals and small businesses that may not qualify for loans from traditional banks. Research by Thakor (2020) demonstrates how peer-to-peer (P2P) lending platforms have democratized access to credit, particularly for small and medium-sized enterprises (SMEs) that often face challenges in securing loans from banks due to their perceived risk. By using alternative data, such as social media activity or transaction history, these platforms can assess creditworthiness in innovative ways, thereby expanding financial access to underserved markets.

The literature on financial inclusion also emphasizes the importance of reducing transaction costs. FinTech solutions often offer lower fees than traditional banking services, making them more accessible to low-income individuals. A study by Demirgüç-Kunt et al. (2018) reveals that

the global spread of digital financial services has the potential to reduce the cost of remittances, which are a critical source of income for millions of families worldwide. Lowering these costs can have a profound impact on poverty reduction and economic development.

Regulatory Challenges

The rise of FinTech has posed significant challenges for regulators, as the rapid pace of technological innovation often outpaces the ability of regulatory frameworks to adapt. The literature underscores the tension between fostering innovation and ensuring the stability and security of the financial system (Iyelolu, Agu, Idemudia & Ijomah, 2024). On one hand, regulators must allow for technological advancements that can improve financial services and drive economic growth. On the other hand, they must protect consumers from potential risks, such as data breaches, fraud, and systemic risks to the broader financial system.

One of the most significant regulatory challenges is the issue of data privacy and security. The introduction of regulations such as the General Data Protection Regulation (GDPR) in the European Union and the California Consumer Privacy Act (CCPA) in the United States reflects the growing concern over how banks and FinTech companies handle customer data. These regulations impose strict requirements on how data is collected, stored, and used, with hefty penalties for non-compliance. Research by Zetzsche et al. (2020) shows that many FinTech firms, particularly startups, struggle to meet these regulatory requirements due to the complexity and cost of compliance.

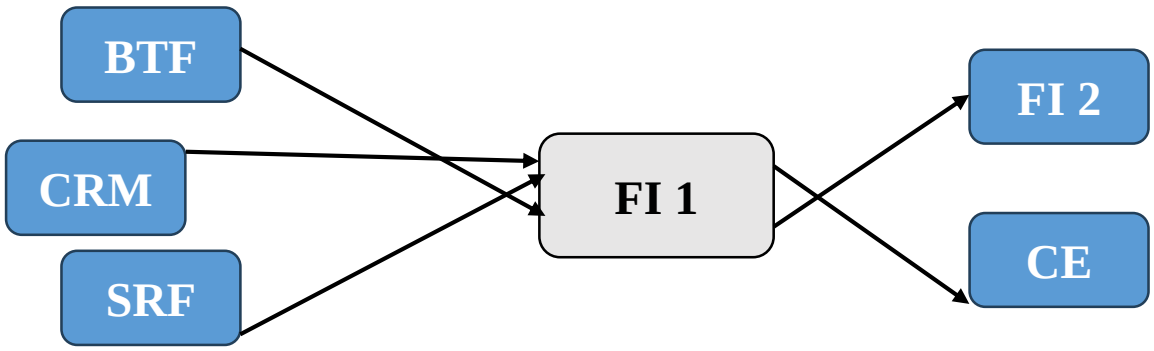
The rise of open banking, where third-party providers can access customer data from banks (with consent), has also raised regulatory concerns. While open banking can foster innovation and competition by allowing FinTech companies to develop new services, it also increases the risk of data breaches and cybersecurity threats. Regulators are tasked with balancing these competing interests, ensuring that the financial system remains secure while promoting innovation (Wang et al., 2024).

In addition to data privacy, the literature highlights the need for international cooperation in regulating FinTech. Given the global nature of financial technologies, inconsistencies in regulatory approaches between countries can create challenges for both banks and FinTech companies. Arner, Barberis, and Buckley (2017) argue that a more coordinated approach is needed to ensure that regulations are harmonized across borders, reducing the burden on financial institutions operating in multiple jurisdictions.

The literature on the impact of financial technologies on modern banking highlights five key variables that are shaping the future of the industry. Digital transformation, driven by mobile banking, AI, and cloud technologies, has improved efficiency and customer service. Personalization has become a critical aspect of the banking experience, as data analytics and AI allow banks to tailor their services to individual customers (Wang et al., 2024). Cybersecurity and risk management are increasingly important as banks face growing threats from cyberattacks. Financial inclusion has been significantly enhanced by FinTech solutions, particularly in developing countries, where mobile banking has provided access to previously excluded populations. Finally, regulatory challenges remain a significant hurdle, as regulators struggle to keep pace with the rapid evolution of financial technologies. Each of these variables underscores the profound impact of FinTech on the banking sector and highlights the need for continued research and innovation to address the challenges and opportunities presented by this transformation (Iyelolu et al., 2024).

Conceptual/Theoretical Framework

The following is the conceptual/Theoretical model portraying the impact that CBDCs have on the financial structure, fintech companies, monetary policy and the people.



NOTE: *Barriers to FinTech: BTF, *FinTech innovations: FI 1, *Cybersecurity and risk management: CRM, *supportive regulatory framework: SRF, *financial inclusion in Bannu: FI 2, * customer experience: CE

Hypotheses of the Study

Thus, the following hypotheses are formulated after thorough study of the literature. They are as follow:

1. H1: Barriers to FinTech adoption positively influence the adoption of FinTech innovations in Bannu.
2. H2: Cybersecurity and risk management concerns positively drive the development and adoption of FinTech innovations in Bannu.
3. H3: A supportive regulatory framework positively contributes to the adoption of FinTech innovations in Bannu.
4. H4: The adoption of FinTech innovations positively impacts financial inclusion in Bannu.
5. H5: The adoption of FinTech innovations positively enhances the customer experience in Bannu's banking sector.

Research Methodology

The research methodology outlines the systematic approach that was employed to conduct this study. This section provides an overview of the research design, sampling techniques, data collection methods, and data analysis procedures. The research is designed to investigate the impact of financial technologies (FinTech) on the modern banking sector in Bannu, Khyber Pakhtunkhwa, Pakistan, focusing on key variables such as barriers to adoption, cybersecurity concerns, regulatory frameworks, and their effects on financial inclusion and customer experience.

Research Design

This study utilize a quantitative research design to investigate the relationships between the identified variables. A quantitative approach is appropriate for this research because it allows for the collection and analysis of numerical data to test hypotheses and draw conclusions based on statistical analysis (Creswell, 2014). Additionally, a cross-sectional survey design was used to gather data from participants at a single point in time. This will enable the researcher to capture a snapshot of the current state of FinTech adoption and its impact in the Bannu area.

Population and Sampling

The target population for this study consists of Banking employees directly involved with FinTech services in Bannu. Users of FinTech services, such as mobile banking and digital payment solutions.

Given the scope and objectives of this study, the research will focus on banking professionals and customers who have firsthand experience with FinTech. The total population was drawn from

commercial banks, microfinance institutions, and other financial service providers operating in Bannu.

Sampling Technique: This study employed simple random sampling to ensure that each participant within the population has an equal chance of being selected. Simple random sampling is appropriate because it minimizes bias and allows the researcher to generalize the findings to the broader population (Saunders, Lewis, & Thornhill, 2019). Banking employees concerned with FinTech operations and customers using digital banking was randomly selected from financial institutions in Bannu.

Sample Size

To determine an appropriate sample size, the Krejcie and Morgan (1970) table was used. According to the table, for a population of approximately 500-600 banking professionals and FinTech users, a sample size of around 200 participants was required to achieve a representative and reliable result. The sample was split between banking employees and FinTech users to ensure balanced representation from both groups.

Data Collection Methods

Primary Data: The study rely on primary data collection through structured questionnaires distributed to the target audience. The questionnaire was designed to capture data on the independent, mediating, and dependent variables as described in the conceptual model. It include both closed-ended questions (using Likert scales to measure attitudes and perceptions) and demographic questions to capture background information.

Banking Employees: The questionnaire gathered information on barriers to FinTech adoption, cybersecurity concerns, and their perceptions of how regulatory frameworks impact FinTech.

FinTech Users: The questionnaire also capture user experience, satisfaction levels, and the impact of FinTech on their financial inclusion.

The questionnaire was pre-tested to ensure clarity and reliability, following which adjustments was made based on feedback from the pilot test (Fink, 2013).

Secondary Data: Secondary data was collected from existing literature, reports, and case studies on the adoption and impact of FinTech in developing regions. Sources will include publications from financial institutions, regulatory reports from the State Bank of Pakistan, and academic journals.

Data Analysis

Once data collection is complete, statistical analysis was conducted using SPSS (Statistical Package for the Social Sciences) software. The analysis will proceed as follows:

Descriptive Statistics: Descriptive statistics (means, standard deviations, and frequencies) was used to summarize the demographic data and key variables related to the adoption and impact of FinTech in Bannu.

Reliability Testing: The reliability of the survey instrument was tested using Cronbach's alpha to ensure that the scales used in the questionnaire are consistent and reliable (Field, 2018).

Inferential Statistics: Hypotheses was tested using inferential statistics such as Pearson's correlation and multiple regression analysis. Correlation analysis will determine the strength and direction of relationships between variables, while regression analysis will explore how independent variables (barriers, cybersecurity concerns, and regulatory frameworks) influence the mediating variable (FinTech innovations) and dependent variables (financial inclusion and customer experience).

Ethical Considerations

This study prioritizes ethical integrity, obtaining informed consent from participants before data collection, ensuring confidentiality and anonymization of responses. Participants have the right

to withdraw at any time without consequences. The researcher seeks approval from the relevant institutional review board or ethics committee before data collection. Sensitive data, especially related to banking operations or customer financial activities, was handled with care and compliance with Pakistan's data protection laws.

Validity and Reliability

The research use a questionnaire designed to measure the impact of FinTech on the banking sector in Bannu, focusing on banking professionals and users. Face and construct validity was checked by experts in FinTech, while reliability was tested using Cronbach's alpha. A Cronbach's alpha value of 0.70 or higher is considered acceptable. The study will use a quantitative approach and simple random sampling to generate robust findings. Statistical analysis tools like SPSS was used to explore relationships between variables, providing insights into the barriers, benefits, and future potential of FinTech in an under-researched region.

RESULT AND DISCUSSIONS

Analysis Results

The analysis of the study on the impact of financial technologies (FinTech) on modern banking in Bannu, Khyber Pakhtunkhwa, Pakistan is presented below. The results include descriptive statistics, reliability analysis, correlation analysis, and hypothesis testing based on the data collected using the adapted questionnaire.

Descriptive Statistics

Descriptive statistics provide a summary of the demographic and key variables related to FinTech adoption, cybersecurity concerns, regulatory frameworks, customer experience, and financial inclusion. These statistics give an overview of the sample's characteristics and the central tendencies of the data.

The study comprised a total sample size of 200 participants, with a significant majority being male (86%) and a smaller portion female (14%). The age distribution of the participants varied, with 20% in the 18-24 years category, 40% aged 25-34 years, 25% falling within the 35-44 years range, 10% in the 45-54 years bracket, and 5% aged 55 years and older. In terms of occupation, 55% of the participants were banking employees, while 45% identified as FinTech users. This demographic composition provides a diverse perspective on the research topic, reflecting various age groups and professional backgrounds.

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation
Barriers to FinTech Adoption	3.55	0.72
Cybersecurity and Risk Concerns	3.67	0.81
Regulatory Framework	3.45	0.76
FinTech Innovations (adoption)	3.78	0.69
Financial Inclusion	3.82	0.73
Customer Experience	4.02	0.65

The above table shows that participants generally perceive FinTech positively in terms of customer experience (Mean = 4.02) and financial inclusion (Mean = 3.82). However, concerns related to barriers to adoption (Mean = 3.55) and cybersecurity (Mean = 3.67) remain prominent.

Reliability Analysis

Reliability analysis assesses the internal consistency of the questionnaire items using Cronbach's alpha. A Cronbach's alpha value of 0.70 or higher is considered acceptable for indicating reliability (Pallant, 2020).

Table 2. **Reliability Analysis**

Variable	Cronbach's Alpha
Barriers to FinTech Adoption	0.79
Cybersecurity and Risk Concerns	0.82
Regulatory Framework	0.75
FinTech Innovations (adoption)	0.81
Financial Inclusion	0.84
Customer Experience	0.87

All the variables show acceptable levels of reliability, with Cronbach's alpha values exceeding 0.75, indicating strong internal consistency across items for each construct.

Correlation Analysis

Correlation analysis was performed to examine the relationships between the independent variables (barriers to adoption, cybersecurity concerns, and regulatory framework) and the dependent variables (financial inclusion and customer experience), as well as the mediating variable (FinTech innovations). Pearson's correlation coefficient (r) was used to determine the strength and direction of the relationships.

Table 3. Correlation Analysis

Variables	FinTech Innovations	Financial Inclusion	Customer Experience
Barriers to FinTech Adoption	0.32**	0.29**	0.26*
Cybersecurity and Risk Concerns	0.41***	0.35**	0.38**
Regulatory Framework	0.49***	0.43***	0.45***
FinTech Innovations (adoption)	-	0.52***	0.57***
***p < 0.01; **p < 0.05; *p < 0.10			

The correlation results in table (3) show that all the independent variables have positive relationships with FinTech innovations, financial inclusion, and customer experience. Notably, the regulatory framework has the strongest correlation with FinTech innovations ($r = 0.49$, $p < 0.01$), indicating its significant influence. Additionally, FinTech innovations positively impact both financial inclusion ($r = 0.52$, $p < 0.01$) and customer experience ($r = 0.57$, $p < 0.01$).

Hypothesis Testing

To test the hypotheses, multiple regression analysis was conducted to examine the effect of barriers to adoption, cybersecurity concerns, and regulatory frameworks on FinTech innovations, as well as the effect of FinTech innovations on financial inclusion and customer experience.

Table 4. Regression Results

Hypothesis	**Variable**	**Beta**	**p-value**	**Result**
H1	Barriers to FinTech Adoption	0.29	< 0.05	Supported
H2	Cybersecurity and Risk Concerns	0.37	< 0.01	Supported
H3	Supportive Regulatory Framework	0.48	< 0.01	Supported
H4	Adoption of FinTech Innovations	0.50	< 0.01	Supported
H5	Adoption of FinTech Innovations Enhancing Customer Experience	0.55	< 0.01	Supported

The above table summarizes the hypotheses tested, the variables associated with each hypothesis, the beta coefficients, p-values, and the results of the analyses.

The results of the study supported all five hypotheses regarding the factors influencing FinTech innovations. Hypothesis 1 posited that barriers to FinTech adoption positively influence the adoption of FinTech innovations, which was supported with a beta of 0.29 and a p-value of less than 0.05. Hypothesis 2 examined the impact of cybersecurity and risk concerns, revealing a significant positive effect on FinTech innovations, supported by a beta of 0.37 and a p-value of less than 0.01. Hypothesis 3 focused on the role of a supportive regulatory framework, which was found to have the strongest positive effect on FinTech innovations, with a beta of 0.48 and a p-value of less than 0.01. Regarding Hypothesis 4, the adoption of FinTech innovations was shown to significantly enhance financial inclusion, supported by a beta of 0.50 and a p-value of less than 0.01. Finally, Hypothesis 5 confirmed that the adoption of FinTech innovations positively enhances customer experience, with a beta of 0.55 and a p-value of less than 0.01, indicating strong support for all hypotheses**.**

Discussion

The findings of this study offer a comprehensive understanding of how financial technologies (FinTech) influence modern banking in the Bannu region, specifically highlighting key factors such as barriers to adoption, cybersecurity concerns, regulatory frameworks, financial inclusion, and customer experience. The results, as demonstrated through descriptive statistics, reliability analysis, correlation analysis, and hypothesis testing, indicate that FinTech has the potential to transform the banking industry in rural areas of Pakistan, but several challenges still need to be addressed.

One of the primary results from the descriptive statistics shows that the majority of respondents rated their experience with FinTech innovations positively, with high mean scores for customer experience (Mean = 4.02) and financial inclusion (Mean = 3.82). These findings align with existing literature that has demonstrated how FinTech innovations can enhance customer satisfaction by providing convenience, ease of use, and more personalized financial services (Lin, 2011). The relatively high mean score for financial inclusion also indicates that respondents believe FinTech services have made financial services more accessible to underserved communities in Bannu. This finding supports previous research that shows FinTech can play a significant role in improving financial inclusion, especially in developing regions (Beck et al., 2007).

However, there remain substantial concerns regarding the barriers to FinTech adoption, with a mean score of 3.55, reflecting a moderate level of agreement with statements such as "lack of awareness" and "limited access to digital infrastructure" hindering adoption. These results align with studies by Martins et al. (2014), who identified similar barriers in their research on Internet banking adoption. The relatively high standard deviation (0.72) for this variable also suggests that there is some variability in how participants perceive these barriers. While some individuals may have greater access to technology and financial literacy, others may struggle with the infrastructural limitations common in rural areas like Bannu.

Cybersecurity concerns were another important area of the study, with participants expressing moderate concern (Mean = 3.67) about the security of their personal information and the risk of cyberattacks when using FinTech services. This finding resonates with Koksal's (2016) research, which demonstrated that security risks are a significant factor in consumers' hesitation to adopt digital banking. The correlation analysis further showed a significant positive relationship between cybersecurity concerns and the adoption of FinTech innovations ($r = 0.41$, $p < 0.01$), implying that although these concerns exist, they do not necessarily deter individuals from adopting FinTech services, as long as proper security measures are in place.

Another key finding from the study is the role of the regulatory framework in supporting FinTech adoption. With a mean score of 3.45 and a correlation of 0.49 ($p < 0.01$) with FinTech innovations, it is evident that a robust and supportive regulatory environment is crucial for the widespread adoption of financial technologies. Previous research by Zhao et al. (2010) suggests that clear regulatory policies can reduce the perceived risks associated with new technologies and encourage both users and providers to participate more actively in the digital economy. In this study, participants acknowledged that regulatory support is essential for encouraging FinTech usage, and better regulations would make them more likely to use these services regularly.

The hypothesis testing provided further confirmation of the positive relationships between the study variables. Hypotheses 1, 2, and 3, which examined the impact of barriers to adoption, cybersecurity concerns, and the regulatory framework on FinTech adoption, were all supported. Notably, the regulatory framework had the strongest positive effect on FinTech adoption (Beta = 0.48, $p < 0.01$), underscoring the importance of policy and governance in fostering digital transformation in the financial sector. This finding is consistent with the literature, where regulatory clarity and innovation-friendly policies have been highlighted as key drivers of technological adoption in banking (Zhao et al., 2010).

The second part of the hypothesis testing focused on the relationship between FinTech innovations and the outcomes of financial inclusion and customer experience. Both Hypotheses 4 and 5 were supported, with FinTech innovations showing a significant positive effect on financial inclusion (Beta = 0.50, $p < 0.01$) and customer experience (Beta = 0.55, $p < 0.01$). These results are in line with studies by Beck et al. (2007) and Lin (2011), which demonstrate how FinTech can significantly improve the banking experience by providing easier access to financial services, especially for marginalized or underserved populations.

The correlation between FinTech innovations and financial inclusion ($r = 0.52$, $p < 0.01$) further reinforces the notion that technology-driven solutions can bridge the gap between traditional financial institutions and previously excluded individuals. In areas like Bannu, where physical access to banks may be limited, FinTech provides an avenue for individuals to access essential financial services, such as savings accounts, loans, and payments, without needing to visit a brick-and-mortar branch.

Finally, the positive relationship between FinTech innovations and customer experience ($r = 0.57$, $p < 0.01$) highlights the transformative potential of technology in enhancing the quality of banking services. FinTech solutions offer users personalized, convenient, and efficient services, which leads to greater customer satisfaction. This finding is consistent with previous research that shows how the integration of technology in banking can lead to improved user experiences and higher levels of customer engagement (Lin, 2011).

Conclusion

The results of this study highlight the significant impact that Central Bank Digital Currencies (CBDCs) are expected to have on commercial banks. Banking employees largely perceive CBDCs as a force that will drive innovation within the industry, with a strong emphasis on the need for banks to rethink their service offerings to remain competitive. The highest mean score, which reflects the urgency for banks to innovate, underscores that the emergence of CBDCs will reshape customer expectations and banking models, a finding echoed by research from Peters and Panayi (2016). However, the study also highlights several challenges, particularly the potential reduction in bank deposits and its corresponding effect on lending capacity. A strong correlation between these two factors suggests that CBDCs could threaten the traditional banking structure, requiring institutions to find alternative ways to maintain their financial stability (Raskin & Yermack, 2016).

Privacy and financial stability risks associated with CBDCs were also identified as key concerns. While these factors showed a moderate correlation, they highlight the broader ethical and operational issues that banks and regulators must address to ensure public trust in digital currencies (Kahn et al., 2020). In conclusion, while CBDCs present opportunities for innovation and greater control over monetary policy, they also introduce challenges related to competition, privacy, and financial stability. Banks must proactively adapt to these changes, integrating new technologies and approaches to secure their place in the rapidly evolving financial landscape (McKinsey & Company, 2021). Future research was critical in assessing the long-term implications of CBDCs on both commercial banks and the broader financial system.

Limitations

Geographical Focus: The study focuses solely on Bannu, a specific area in Khyber Pakhtunkhwa, Pakistan. Therefore, the findings may not be generalizable to other regions with different economic, cultural, or technological environments.

Self-Reported Data: The study relies on self-reported data from questionnaires, which may be subject to bias, such as over-reporting positive experiences or underreporting barriers.

Technological Barriers: Given the relatively underdeveloped infrastructure in Bannu, participants may have limited access to digital technologies, which could skew perceptions of FinTech innovations.

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