

Achieving Equilibrium: Exploring the Connection between Artificial Intelligence and Digital Innovation to Enhance Banking Services

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Abstract

The primary objective of this study is to investigate the use of artificial intelligence (AI), digital innovation, and Fintech to promote banking services in Pakistan. To achieve these goals, a questionnaire-based survey was conducted. The study examined a range of people in Pakistan, including shoppers, business owners, and employees in the banking and financial sectors. The findings elucidated the intricate relationships among AI, digital innovation, and Fintech within Pakistan's banking sector. The poll results indicate that people across demographic groups recognize and use AI-powered financial services and FinTech platforms to varying degrees. The results of this study will affect many people in the banking industry and the economy. To better meet the needs of diverse client groups, financial institutions can use data to refine their AI and FinTech strategies. Regulators might use findings from the study to develop regulations ensuring that these technologies are safe and ethically sound.

Keywords: Artificial intelligence, digital innovation, FinTech, banking services, online banking.

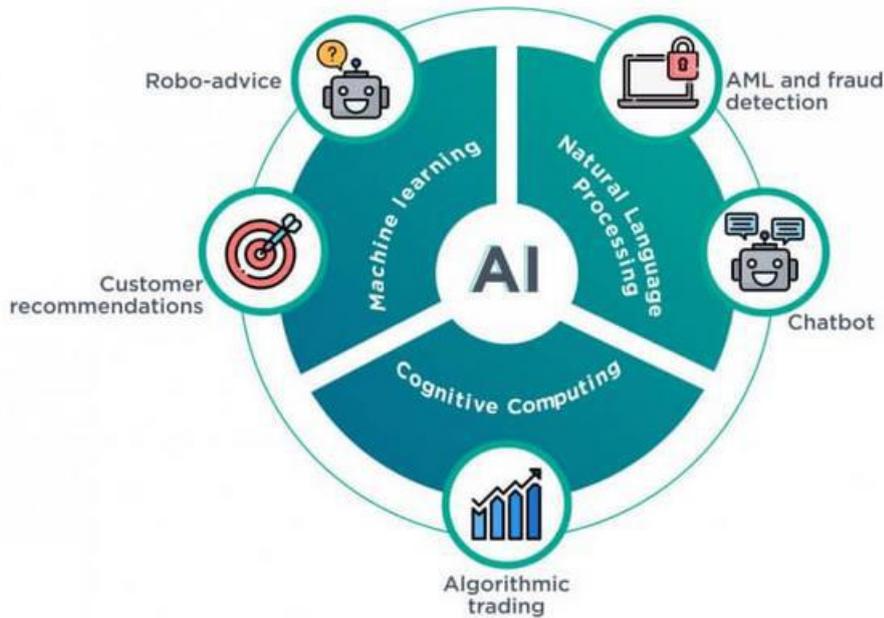
Introduction

The banking sector is rapidly adopting technology to manage global wealth through databases and transactions that primarily transmit information across networks (Cooke et al., 2019; Ong et al., 2017; Shair et al., 2021). A variety of fields, including accounting, sales, contracts, and cybersecurity, could benefit from the latest technology, particularly artificial intelligence (AI). To enhance banking solutions for its clientele as part of digitization efforts, banks are progressively collaborating with financial technology (FinTech) firms. By 2023, research projects that artificial intelligence will yield \$447 billion in savings for banks. Figure 1 illustrates the application of AI in financial services. It encompasses customer endorsements, chatbot functionality, and fraud-detection mechanisms.

Financial Technology, commonly referred to as FinTech (Dwivedi et al., 2021; Muryanto et al., 2022), represents a transformative phenomenon in the contemporary financial landscape, driven by the convergence of technological advancements, digital innovation, and artificial intelligence. It plays a pivotal role in financial services across many financial institutions. This merger has disrupted conventional financial services by providing innovative solutions that meet the evolving needs of individuals and businesses. As global economies embrace this paradigm shift, countries such as Pakistan are increasingly recognizing the potential of AI-driven digital innovation to transform their banking sectors. This paper analyzes the intricate relationships among AI, digital innovation (Kerna & Wolff, 2019; Madzik et al., 2023), and fintech within Pakistan's banking sector, emphasizing the benefits and drawbacks of this amalgamation. In this decade, the use of AI is increasing markedly

across diverse institutions for financial operations. The banking system in Pakistan has undergone substantial changes in recent decades, transitioning from traditional physical institutions to a more technologically advanced and digitally oriented industry. The proliferation of mobile phones and internet access nationwide has expanded access to digital financial services, overcoming geographical barriers. The concurrent rise of FinTech firms and the adoption of AI have accelerated the transformation of banking services, rendering traditional models obsolete. Pakistan, with a population exceeding 220 million, constitutes a significant market for innovative financial solutions.

Figure 1.



Use of AI in Financial Services

However, to fully exploit this potential, there is a need for synergy between AI, digital innovation, and FinTech. It is difficult for any industry to be isolated and unaffected by advances in these times of intense competition and numerous technical advancements. Technology that enables machines to simulate human intelligence is included in AI (Chen et al., 2020; Rodgers et al., 2023), a subfield of computer science. Components of AI known as Machine Learning (ML) and Natural Language Processing (NLP) have grown significantly in importance in the world of digital innovation. Both ML and NLP have a critical role in the implementation of AI. Predictive analytics is made possible by ML algorithms, which analyze enormous amounts of data to find patterns and trends. Contrarily, NLP enables language-based interaction between people and machines, paving the way for chatbots and virtual assistants that can assist customers in real time. Hence, in the banking industry, the use of ML and NLP is important to promote AI. The combination of AI and digital innovation has the potential to overcome accessibility and financial inclusion gaps in the Pakistani setting. Digital platforms powered by AI can provide safe and practical banking options for the large section of the population that is still underbanked or unbanked. By extending financial services to remote locations and leveraging AI algorithms for risk assessment and fraud detection, mobile banking applications can give previously underserved regions access to transactions, savings, and credit. Thus, the main goal of this study is to look into how AI, digital innovation, and fintech are used to promote banking services in Pakistan.

Literature Review Banking Services

Online banking refers to a system that enables bank customers to conduct various financial transactions via the institution's website or mobile application (Rahi et al., 2017). Since the early

2000s, this has been the primary means by which individuals access their bank accounts. The internet banking system will interact consistently with the bank's core banking system, enabling consumers to access financial services as an alternative to conventional branch banking. Online banking significantly reduces banks' operational costs by eliminating dependence on a branch network. Some consumers find it beneficial as it reduces the need to visit a branch bank and allows them to manage their finances even when branches are closed. Online banking services are available to both consumers and businesses (Ong et al., 2017; Ting & Hongmei, 2015). Fintech is driving this transformation, integrating a wide range of technological tools to enhance financial services (Al-Dmour et al., 2020; Naeem & Akhtar, 2021). The FinTech ecosystem encompasses peer-to-peer lending platforms, robo-advisory services, blockchain-based assets, and digital payment systems. The emergence of digital wallets and payment gateways in Pakistan has accelerated the transition to cashless transactions, enhancing the security and convenience of financial operations. The integration of FinTech with AI-driven technologies (Khan et al., 2021) holds substantial promise for improving the effectiveness and efficiency of financial services. The capabilities of robo-advisors can be enhanced by AI-driven algorithms that evaluate transaction data to produce tailored financial recommendations. Predictive analytics can optimize targeted marketing campaigns, hence enhancing consumer retention and engagement. The symbiotic relationship between FinTech and AI-driven innovation is essential for addressing ongoing challenges and promoting financial inclusion as Pakistan's economy becomes increasingly digitized. Figure 2 depicts the study's framework, highlighting the effect of AI and digital innovation on FinTech and its subsequent impact on banking services.

Artificial Intelligence

To enhance customer relationship management, artificial intelligence is utilized in the banking industry (Chen et al., 2020; Rodgers et al., 2023). This industry is implementing customer-centric practices from the ground up to achieve new heights. Customer relationship management, encompassing communication with clients, is a fundamental aspect of the banking sector's engagement with its customers. The introduction of ATMs altered consumers' choices regarding bank visits. These devices enable direct communication between input locations and cash withdrawal and deposit functions, eliminating the need for human intervention. Artificial intelligence has gained increasing popularity due to a revolution (Xu et al., 2022). The digitalization of banking is evolving. The sector's landscape has transformed over the past few decades, driven by services such as real-time money transfers, mobile banking, and online banking. The menace posed by the internet is escalating due to heightened digitization. To uphold user trust and ensure secure transactions, these services must again be safeguarded against cybercrime.

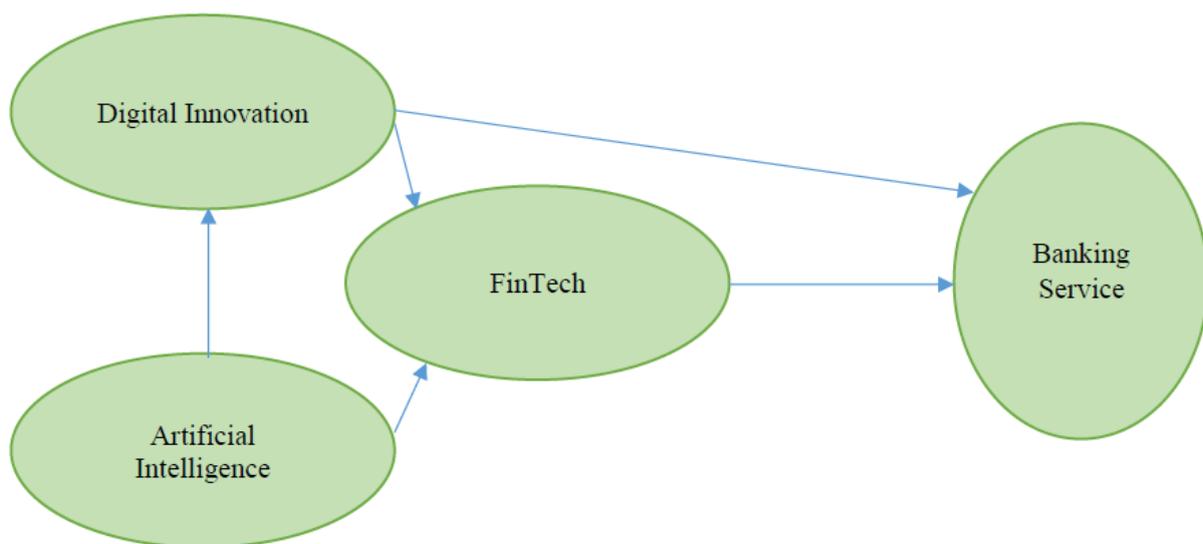


Figure 2.

The study's framework illustrates the impact of AI and digital innovation on FinTech, resulting in advancements in banking services.

The convergence of businesses such as banking, telecommunications, and information technology results in a plethora of valuable user information available online. All reports provided by users possess identical security and vulnerability levels. Government authorities have instituted stringent regulations to enhance the banking sector's ability to manage this vast volume of data due to the disruptive nature of cybercrimes. The integration of AI enables banks to compete with FinTech companies, representing a significant advantage of digitization for financial institutions. A 2020 joint study by the National Business Research Institute and Narrative Science indicates that 32% of banks currently utilize AI technologies. Artificial intelligence in banking enables banks to process vast quantities of data at unprecedented speeds, facilitating profound insights and enhanced comprehension of client behavior. Artificial intelligence in finance can currently tailor financial products and services (Basri, 2020; Li & Liu, 2022), leading to enhanced consumer engagement and the formation of trustworthy customer relationships. This is facilitated by the ability to provide tailored features and seamless interactions.

Digital Innovation

The financial services industry is undergoing "digital transformation" to enhance operational efficiency, elevate customer experiences, and adapt to the evolving market landscape by integrating digital technologies and innovative business practices (Boonmalert et al., 2021). The application of the invention illustrated in Figure 3 as the basis for the design thinking process is proliferating among financial institutions. Emerging participants in the banking ecosystem enjoy enhanced autonomy due to advancements in digital technologies. This establishes a "David vs. Goliath" dynamic that allows for rapid iteration, in contrast to established institutions. Such scenarios have occurred throughout the past decade across various consumer sectors, including travel, accommodation, media, and photography.

Although numerous industries have been affected by advancing technology, banking and fintech remain insulated, largely because of their essential nature and stringent regulation, which ensure the secure custody of funds for individuals and enterprises. The regulation and strategic importance of economic stability might hinder the entry of new rivals into the market. The banking sector, once characterized by traditional physical establishments, is today leading in digital innovation (Madzik et al., 2023). The necessity for digital transformation has become evident due to evolving client expectations and an increasing demand for seamless, tailored services.

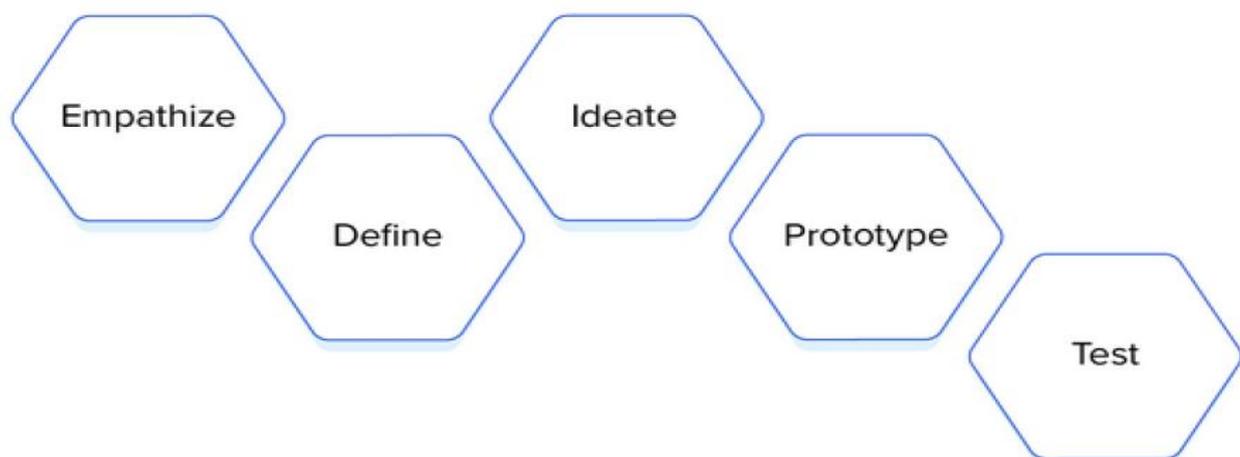


Figure 3.
Digital Transformation of Technology

Financial institutions can enhance their service offerings, optimize operations, and maintain competitiveness in a rapidly evolving market by adopting advanced technologies and user-focused solutions. The emergence of disruptive fintech companies that challenge the status quo and the necessity of meeting the demands of tech-savvy clientele have heightened the impetus for enterprises to adopt digital strategies. Financial institutions must vigorously modify their business operations (Akomeah et al., 2018; Yamori et al., 2017) to sustain value in the digital banking era. Digital transformation in banking is an ongoing process aimed at restructuring the financial services sector through the integration of advanced technologies, innovative business models, and customer-centric strategies to meet the evolving demands of the digital era. Most financial firms recognize the numerous advantages of this approach, although others remain hesitant to abandon established methods. Optimal operations can be achieved by radically transforming how technology delineates corporate activities, processes, competencies, and frameworks.

FinTech

Fintech, commonly known as financial technology, refers to innovative technologies designed to improve and automate financial services (Demirguc-Kunt et al., 2018; Dwivedi et al., 2021). Fintech is mostly employed to aid organizations, entrepreneurs, and people in optimizing their financial operations, processes, and lives. The terms financial services and digital technology converge to create the word "FinTech," or financial technology. FinTech is the innovative utilization of technology in the development and delivery of financial services. FinTech in banking has influenced numerous applications and transformed the assessment of clients' finances. It influences various sectors, including finance, insurance companies, and mobile payment applications such as Square (Al-Dmour et al., 2020). Fintech firms are assailing traditional banks from multiple fronts, systematically dismantling the barriers established by incumbents over the last century (Naeem & Akhtar, 2021). Emerging innovators in digital banking are presenting challenges to the banking and broader financial sectors across various industries, including lending, investment management, payments, and currencies. FinTech emerged in the 1950s with the introduction of the first credit card by a diner's club.

The inaugural ATM was installed by Barclays Bank in 1967, signifying the commencement of technology's formal application in the financial services sector. This marked the definitive transition from technology to digital technology. The financial services market has been disrupted by fintech companies due to their innovative user experience techniques. They are renowned for being more cost-effective, as well as faster, more efficient, and more secure than traditional banks. Consequently, numerous fintech enterprises have effectively garnered client confidence by delivering exceptional customer service and significantly depending on word-of-mouth promotion (Demirguc-Kunt et al., 2018). Financial institutions can gain advantages by embracing a fintech strategy and focusing on improving their client experience. Consequently, customers may experience enhanced service, perhaps leading to increased patronage and trust in the bank. In other words, by adopting the customer-centric concept of FinTech, banks may improve their services. The use of web-based platforms is referred to as mobile banking. The worldwide mobile banking industry is projected to attain approximately US\$1824.7 million by 2026, according to a report by Allied industry Research. Currently, most banks have a mobile banking application that delivers nearly all services available through traditional banks and features an intuitive user experience. They have additionally provided clients with the option of fingerprint recognition. The application accomplishes this operation without employing any hardware or software for biometric identification. A mobile banking application enables users to do several banking functions (De Leon et al., 2020; Fehmeen, 2010), such as expedited bill payments, check deposits, account balance inquiries, statement requests, and more services.

Hypotheses of the Study

In accordance with the study framework illustrated in Figure 2 and the preceding discussion, the present investigation posits the following hypotheses:

- Artificial intelligence impacts digital innovation.
- H2. Artificial intelligence impacts the FinTech sector.
- H3. Digital innovation impacts FinTech.
- H4. Digital innovation impacts financial services.
- H5. FinTech impacts financial services.
- H6. Digital innovation serves as a mediator in the link between artificial intelligence and FinTech.
- H7. FinTech facilitates the connection between digital innovation and banking services.

Research Methodology

The study seeks to enhance comprehension of the present condition, challenges, opportunities, and outlook at this dynamic intersection by analyzing the collected data, which will guide the development of strategies to leverage these technologies for the advantage of the banking sector and the broader economy. A survey questionnaire was employed to examine the utilization of AI, Digital Innovation, and FinTech in enhancing banking services in Pakistan. This technique enables the collection of quantitative data from a diverse array of respondents, yielding insights on attitudes, experiences, and trends related to the study topic. The questionnaire is crucial for ascertaining public sentiment.

Questionnaire surveys serve as a dependable method for obtaining critical information regarding the integration of AI, digital innovation, and fintech in enhancing banking services in Pakistan. The study examined a diverse demographic in Pakistan, encompassing consumers, entrepreneurs, and individuals involved in the banking and financial sectors. The major target audience comprised customers, business owners, and participants in the banking and financial sectors. Purposive sampling facilitated data collecting in this investigation. Purposive sampling ensured representation from diverse groups. The questionnaire's design effectively captured a comprehensive understanding of the utilization of AI, digital innovation, and fintech in advancing financial services. Data analysis utilized 350 valid responses to evaluate the study hypotheses.

Data Analysis

This work utilized Smart PLS (refer to Figure 4), a suggested technique for analyzing data obtained from survey questionnaires (F. Hair Jr et al., 2014; Hair Jr et al., 2021; Malik et al., 2018). Smart PLS is a software package featuring a graphical user interface designed for variance-based structural equation modeling using the PLS path modeling technique. An increasing contingent of scholars and researchers is utilizing SMART-PLS for data analysis in their research activities (Naveed et al., 2019; Tajeddini et al., 2022; Ul-Hameed et al., 2019). In SEM, a model is initially assessed for the precision of its measures (Measurement Model), followed by an analysis of the interactions among the variables (Structural Model). This study assessed reliability using factor loading exceeding 0.7 and composite reliability surpassing 0.5. Furthermore, Table 1 presents discriminant validity by HTMT0.9.

Figure 4.
Smart PLS

Table 1.
HTMT_{0.9}

	Artificial Intelligence	Digital Innovation	FinTech	Banking Services
Artificial Intelligence				
Digital Innovation	0.802			
FinTech	0.821	0.65		
Banking Services	0.792	0.753	0.799	

The findings of this study are derived from the structural model of Partial Least Squares (PLS) (Hair Jr et al., 2020; Kock, 2015). A t value of 1.96 or higher is utilized to accept the hypotheses, whereas a t value below 1.96 is deemed to reject the hypotheses. Table 2 presents all the data, indicating that the t values for all hypotheses exceed 1.96, hence validating all hypotheses. Additionally, the mediation effect presented in Table 3 is very significant. The results of the direct effect are presented in Figure 5 and Table 2.

Table 2.
Results (Direct Effect)

Hypothesis	Relationship	Beta Value	t-value	p-value
H1	Artificial Intelligence → Digital Innovation	0.352	4.58	0.00
H2	Artificial Intelligence → FinTech	0.589	5.88	0.00
H3	Digital Innovation → FinTech	0.231	3.399	0.001
H4	Digital Innovation → Banking Services	0.351	3.335	0.001
H5	FinTech → Banking Services	0.099	2.01	0.044

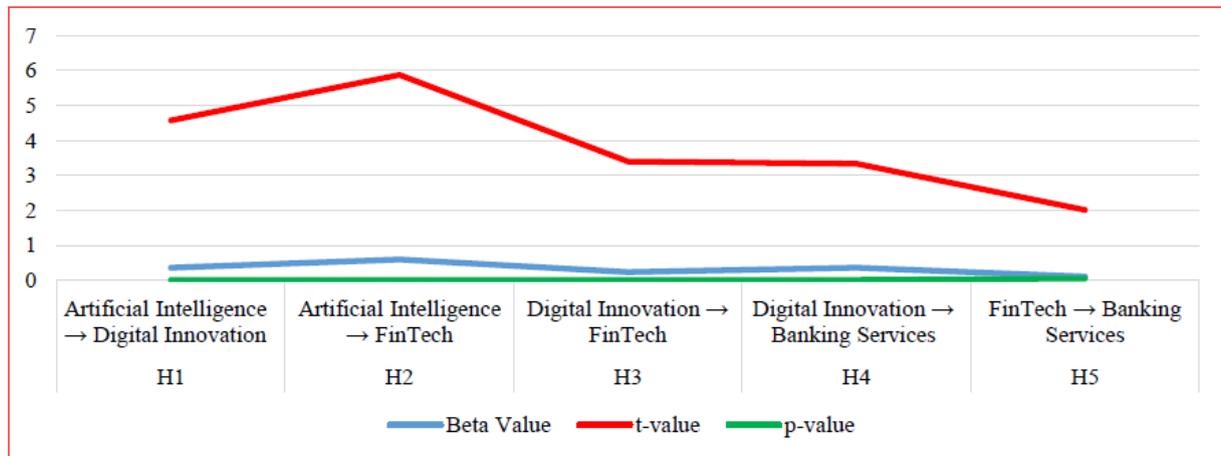


Figure 5.
Results of Direct Effect

Table 3.
Results (In-Direct Effect)

Hypothesis	Relationship	Beta Value	t-value	p-value
H6	Artificial Intelligence → Digital Innovation → FinTech	0.092	1.982	0.047
H7	Digital Innovation → FinTech → Banking Services	0.623	10.08	0.00

Conclusion, Implications and Future Directions

FinTech, digital innovation, and artificial intelligence are converging to transform the banking sector in Pakistan. This integration can democratize financial services by enhancing operational efficiency and client experiences, hence expanding access for underserved populations. The banking sector in Pakistan can surmount challenges and capitalize on opportunities by leveraging AI-driven insights and FinTech solutions to establish a more inclusive, efficient, and dynamic financial environment. The advancement of artificial intelligence is pivotal in the improvement of banking services. Ultimately, it is evident that the amalgamation of FinTech, digital innovation, and artificial intelligence exemplifies the transformation occurring within Pakistan's banking sector. This research demonstrates that these three pillars may revolutionize traditional financial services, enhance accessibility, and elevate user experiences to unprecedented heights.

These forces are driving digitalization. By creating synergies between AI-driven insights and FinTech skills, Pakistan's banking sector may overcome challenges and capitalize on opportunities, thereby steering the country towards a more inclusive, efficient, and progressive financial ecosystem. This integration possesses a vast array of potential impacts. The convergence of digital innovation and artificial intelligence can enhance operational efficiency, facilitate data-driven decision-making, and provide access to financial services for the underbanked and unbanked populations. The advent of AI-driven chatbots offering analytics, tailored financial guidance, and predictive modeling has the potential to transform client interactions and enhance financial literacy across diverse socioeconomic strata. The rapid proliferation of FinTech can transform payment methods, facilitate the growth of SMEs, and democratize access to financing. Consequently, the potential of AI is essential for improving banking operations in Pakistan to increase consumer engagement. The integration of AI,

digital innovation, and fintech offers a framework for a future where financial services are more intelligent, efficient, and inclusive, underscoring the importance of this study. During this transition, all stakeholders must remain steadfast in their commitment to ethical thinking, responsible innovation, and the paramount goal of enhancing the welfare of all Pakistanis. The banking sector in Pakistan exemplifies the remarkable potential that arises when human creativity and technological innovation converge, effectively addressing challenges with foresight and enthusiastically capitalizing on opportunities.

Artificial intelligence and digital innovation can facilitate FinTech applications in the banking sector, resulting in enhanced performance. Examining the ethical implications of algorithmic biases, data privacy, and automated decision-making is essential as AI technologies become increasingly prevalent in the financial services sector. The primary objective of future research should be the formulation of frameworks that incorporate justice, transparency, and accountability. The integration of AI, digital innovation, and FinTech may enhance financial services; nonetheless, it is essential to evaluate its impact on financial inclusion. Future study should concentrate on how these technologies may bridge the divide between urban and rural areas, enabling previously underserved people to access and benefit from modern financial services.

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