

THE IMPACT OF ISLAMIC FINTECH ADOPTION ON BANKS' SUSTAINABILITY PERFORMANCE: EVIDENCE FROM ISLAMIC BANKING INSTITUTIONS IN KHYBER PAKHTUNKHWA, PAKISTAN

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Abstract

This research aims to examine the effect of Islamic FinTech adoption on the sustainability performance of banks in Islamic banking institutions in the Khyber Pakhtunkhwa, Pakistan. Based on the Ecological Modernization Theory (EMT) and the Dynamic Capabilities Theory (DCT), the study looks at the role of the digital financial innovation in the economy, the environment, and the social sustainability. A cross-sectional quantitative research design is applied; where data is collected from managers and employees of Islamic Banks (N=280) with the help of a structured questionnaire and analyzed with PLS-SEM application in SmartPLS. The results indicate the a significant favorable impact of the Islamic FinTech adoption on the three-fold sustainability performance dimensions. This shows the effect of technology in boosting efficiency, inclusivity, and environmental responsibility. The research offers valuable theoretical and managerial implications, which focus on the relevance of ethical and technology-based approaches that encourage sustainable development of Islamic finance. Findings build the knowledge on the transformative nature of FinTech to attain sustainable banking in the emerging economies.

Introduction

Banking is currently experiencing a paradigm shift through the rapid advancement of financial technology (FinTech) that is altering the way financial service can be designed, delivered and experienced (Khan, Amin and Akbar, 2025). Technology in financial system has stimulated, an innovation venture that is efficient and inclusive and offers solutions to the challenges of economic and sustainability. Islamic FinTech (Islamic finance blended with digital innovation) has been emerging as a new dimension of this change in recent years particularly within Muslim-majority nations (AlZakwani et al., 2025; Sadek et al., 2024). The Islamic FinTech represents a

technological revolution and a paradigm shift that lies in ethical, inclusive, and sustainable financial practices (Azman et al., 2020). This is a paradigm shift, where the question of how Islamic FinTech can lead to the sustainability of banks, as a multidimensional concept that takes on the form of financial stability, environmental responsibility, and social well-being. Therefore, it is now essential and timely to examine this topic of research. Banking world-wide has been experiencing increased pressure to align its operations with the provisions of sustainable development. The SDGs have made financial institutions reconsider their role in making economic growth to meet sustainability both economically and socially

(Stauropoulou et al., 2023). Sustainability has thus become a strategic need of the banks hence influences their policies and operations as well as their patterns of investment (Khan et al., 2025). According to the extant research, FinTech has been considered a significant driver in moving towards the achievement of sustainability by means of financial inclusion, reduced consumption of resources, and green investments (Yan et al., 2022). In the FinTech technologies portfolio, blockchain, digital source of payments, P2P lending, and mobile banking solutions have demonstrated the potential. This has also demonstrated the opportunity of enhancing environmental efficiency and resilient operations to transform the financial ecosystem in a sustainable manner (Chueca Vergara, and Ferruz Agudo, 2021)

FinTech has been instrumental in achieving and filling the financial gaps within developing economies by enabling inclusive growth (Fan et al., 2023). The studies of Bangladesh and Pakistan focus on the fact the use of FinTech can contribute significantly to the increase of sustainability performance in the sphere of increasing access to financial services, and financing green projects (Raza et al., 2024; Yan et al., 2022). Besides, using FinTech has a good relationship with green innovation and financial inclusion, which are critical actors in the long-term sustainability strategy test result (Yan et al., 2022). Bonsu et al. (2025) work goes an additional notch further to report that fintech plus green finance and information technology governed performance support sustainable performance in the African banking systems. This extends the notion that both the technological, as well as, institutional abilities collaborate to produce sustainable transformation (Bonsu et al., 2025). Altogether, these results indicate that there is a growing congruity that FinTech innovations, with proper alignment with the sustainability goals, can become a catalyst of responsible banking.

Nevertheless, Islamic banking institutions (IBIs) are an underexplored empirical phenomenon in the FinTech-sustainability nexus. Islamic finance is based on the principles of risk sharing, bans on interest (riba), and encouragement of ethical

investment, which are already consistent with sustainability objectives. However, the implementation of the FinTech in the Islamic banking, particularly in the emerging economies, like in Khyber Pakhtunkhwa (KP), Pakistan in its nascent phase. Despite a fast growing global Islamic FinTech market, that is valued over USD 179 billion by 2025, much of the existing literature has focused on the tradition (conventional) systems of financial systems. These has failed to research the specific characteristics of Islamic Banking industry, its problems and opportunities. This is a tremendous research gap, and a research needs to be conducted to find out how the sustainability of the Islamic banks can be spurred through Islamic FinTech which can ensure operational efficiencies, financial inclusiveness, and Shariah-compliant innovation (AlZakwani et al., 2025).

The extant literature has shown that the adoption of FinTech can enhance financial and non-financial performance through the mechanisms of digital transformation, cost efficiency, and growth due to innovations (Deng, Huang, and Cheng, 2019). In this regards, Dwivedi et al. (2021) observed significant competitive advantages and performance benefits in banks in the United Arab Emirates in case of utilization of FinTech. This fact explains the transformative character of the digital finance phenomenon. Similarly, according to the research of Albuainain and Ashby (2025), technological convenience, confidence, and safety are the key predictors of FinTech adoption in the post-COVID financial environment. These findings align with the model of Technology Acceptance Model (TAM) which puts an emphasis on the relevance of perceived usefulness and perceived ease of use to the technology adoption process (Raza et al., 2024; Saeed, Xigen, Ahmad, Dukhaykh & Khan, 2025). Moreover, the introduction of FinTech as the sustainability strategy development resonates with the Dynamic Capability View (DCV) and the EMT, which elaborates on the idea that technology innovation can be used to make companies adapt to changes in the environment and strive towards sustainable competitiveness (Bonsu et al., 2025).

There is also empirical evidence by showing that FinTech helps to spread Green Finance (GF) and Green Innovation (GI), as these factors are important in promoting environmental and organizational sustainability. To exemplify it, Yan et al. (2022) identified direct and indirect mechanisms through which the adoption of the FinTech influences sustainability performance by demonstrating how green finance and innovation mediate around a hybrid SEM-ANN model. According to them, the green innovation is the most powerful predictor of sustainability, and the next includes a green finance and adoption of FinTech itself. This sort of finding illustrates the necessity of implementing financial tech that is inclined towards sustainable practices to report holistic findings of sustainability outcomes. Zhang et al. (2022) have found that positive impact of green banking operations on environmental performance mediated by green financing means that the processes of strategic eco-friendly finances are quite relevant. The knowledge could be particularly helpful when it comes to Islamic banking, in which the ethical issue and environmental care are part of faith-centered enterprise.

Despite the significant literature of the classical FinTech study, the Islamic FinTech presupposes the application of another paradigm according to which technological progress is combined with religious and ethical thinking. This distinction can uniquely apply in the Pakistani context of Islamic banking where financial operations must be aligned with Shariah requirements (Ullah, Harwood and Jamali, 2018). In some parts like Khyber Pakhtunkhwa, Islamic banking institutions are very important tools of financial inclusion, poverty eradication and social welfare. Nevertheless, these banks are disadvantaged in terms of operational structure such as poor technological status, low digital literacy, and inaccessibility to new financial products. The way Islamic FinTech could address these issues is to digitize Shariah-compliant products, improve financial access among unbanked communities and minimize operational inefficiencies. In addition, the incorporation of sustainability in their technology structures can enable Islamic

banks to improve their triple bottom-line performance-financial, social, and environmental-in accordance with the trend on sustainable finance in the world.

Although the potential of FinTech has become increasingly acknowledged, relatively little empirical data has been gathered to associate Islamic FinTech with the sustainability of banks, which, again, in the Pakistani context. The majority of the current research have analysed FinTech and sustainability in traditional or hybrid banking frameworks with little focus on the institutional, cultural, and regulatory peculiarities of Islamic finance. In addition, not many studies have empirically outlined this relationship in an advanced analytical method like PLS-SEM through which causal relationship can ultimately be analyzed well. Filling in these gaps, the present study tends to fill in the gaps by providing an empirically conducted investigation of the impact of using Islamic FinTech on ensuring sustainable status of banks in the Islamic Banking Institutions in Khyber Pakhtunkhwa through a survey data among managers and employees evaluated with help of PLS-SEM using SmartPLS software. Based on this, the present study is aimed at addressing the following research question:

Does Islamic FinTech adoption significantly enhance the sustainability performance of Islamic banking institutions in Khyber Pakhtunkhwa?

By doing so, the study will add to the growing body of literature regarding FinTech-related sustainability, green finance, and Islamic banking innovation. The research also builds upon the previous research by Raza et al. (2024), Bonsu et al. (2025), and Yan et al. (2022) by framing the sustainability effect of FinTech in the context of a Shariah-compliant framework and in a developing regional economy. In the practical sense, the results will inform bank managers, policymakers, and regulators of the strategic value of creating and adopting Islamic FinTech platforms to improve the environmental, economic, and social sustainability. Theoretically, the study contributes to the knowledge of FinTech as either a technological potential or an ethical facilitator of sustainability by providing a new subservice of

recognizing technological development with Islamic ethical finance as a key determinant.

2. Literature Review

2.1 FinTech Adoption in Banking

The digital revolution has altered the banking industry distinctly, and the notion of Financial Technology (FinTech) is becoming a revolutionary initiative to become more productive, inclusive, and creative. The adoption of ensuring access to the most innovative digital technologies in the process of banks, such as artificial intelligence, blockchain, big data analytics, and mobile apps, is called FinTech adoption (Galeone et al., 2024). FinTech became a phenomenon in both the developed and developing economies as a result of transparency, financial inclusion, and operations survivability. Current studies have underscored different antecedents of FinTech adoption. Hidayat-ur-Rehman et al. (2025) discovered the role of accessibility, security, and financial literacy in the adoption of FinTech in rural Pakistan and showed that digital literacy and infrastructural preparation are the foundation of a successful diffusion of technologies. Comparatively, Igamo et al. (2024) have found consumer perceptions of benefits and risk as critical determinants of FinTech adoption and thus increased by contextual forces, such as fear of COVID-19. These findings on behavior use help to emphasize that the acceptance of FinTech is not only technological but also socio-psychological, where trust, privacy considerations, and the perceived usefulness influence the different ideas (Odumuwagon, 2025).

In addition to user-level determinants, institutional adoption is becoming associated with sustainability reasons. FinTech is now considered not only as a competitive requirement by banks, but also as a strategic direction towards efficiency, cost and environmental performance (Bhuiyan et al., 2024). However, challenges persist. Regulatory leave, cyber security threats, and the digital gap make homogeneous adoption among the banking systems in emergent economy to be difficult, particularly among emerging economies (Wu et al., 2024). The discussion on ethical issues in privacy, accountability, and transparency in most

areas is under-researched, so it is not clear whether FinTech development combines the developmental goals of sustainable, ethically driven banking (Mhlanga, 2023). Overall, the research show that the adoption of FinTech banking can be seen as a complex of both technological opportunities and political culture together with regulatory readiness. It provides a platform of strategic location to guarantee the creation of inclusive and sustainable financial systems.

2.2 Sustainability Performance in Banks

Sustainability performance in banking is the concept that transcends the traditional profit-related measures; it is also comprised of the economic, social, and environmental factors. Banks play very crucial roles in funding sustainable development through responsible lending, investing in renewable and sustainable products, and performing business that are econ-friendly (Naz et al., 2023). The latest (since 2016) literature has observed the tendency toward sustainable banking, which has been triggered by an international agenda, which includes the SDGs or the Paris Agreement. Measures adopted to operationalize sustainability performance have commonly been based on green finance, green innovation, environmental risk management, and corporate social responsibility (CSR). As an example, Bonsu et al. (2025) have shown that banks that implement FinTech and green finance are more sustainable and that the information technology governance is a moderating variable. Likewise, Guang-Wen and Siddik (2023) have identified that green innovation and green finance intervene in the connection between FinTech adoption and sustainability performance, confirming the hypothesis that sustainability is realized not only by digital transformation but also by organizational learning and innovation.

But the critical literature holds that sustainability in banking is frequently facade, being limited by compliance-only practices and profit-making processes. Rahman et al. (2024) argues that FinTech is the solution to sustainable transformation, although its implementation without an ethical lens could result in so-called

techno-sustainability gaps. Dunbar et al. (2024), also sound an alarm about the "promises and pitfalls of FinTech and the implication that technological innovation should be placed within ecological and ethical frameworks that are systemic. Nonetheless, despite these obstacles, sustainability performance is now a competitive edge, improving the corporate image and credibility among stakeholders. Digital and green adoptive banks are more likely to prosper as they reduce profitability and social and ecological responsibility (Siddik et al., 2023).

2.3 Theoretical Framework and Hypotheses Development.

Two complementary theoretical frameworks; EMT and DCT; offer a strong basis to perceive how FinTech adoption fosters sustainability performance.

According to the Theory of Ecological Modernization, technological innovation can balance economic growth and environmental conservation by installing ecological rationality in finances. According to EMT, FinTech is a tool of attaining sustainability through improved energy efficiency, increased transparency, and environmentally friendly funding (Bonsu et al., 2025). Such FinTech-enabled solutions as blockchain-based green bonds and risk scoring systems provided by AI demonstrate how modernization in the environmental context can be attained through technological advances. Research works by Gupta and Modi (2025) and Dunbar et al. (2024) confirm that FinTech can take green transitions through enabling resource-efficient and low-carbon-based financial operations.

Dynamic Capabilities Theory focuses on the capacity of an organization to combine, construct, and restructure competencies in response to change in the environment (Muithya & Muathe, 2020). Under the FinTech-sustainability nexus, DCT discusses how banks can establish adaptive/imaginative facets to harness FinTech instruments to perform sustainably (Siddik et al., 2023). The adoption of FinTech will become a reflection of dynamic capabilities that will allow banks to discover opportunities of sustainability,

implement green innovations, and align digital transformation to environmental objectives (Jia et al., 2025).

Collectively, both EMT and DCT can be used to provide a comprehensive explanation: EMT is concerned with why FinTech can contribute to sustainability, whereas DCT is about how banks can operationalize such a contribution (through dynamic adaptation and learning). These theories can be combined to give a comprehensive consideration of the technological, organizational, and ecological processes underlying the sustainable digital transformation in banking.

2.3.1 Financial Technologies and Bank Sustainability.

The recent literature recognizes Fintech implementation as one of the core drivers of the sustainability of enterprises at the level of bank, greater efficiency, transparency, and environmental responsibility in the financial sector. FinTech introduces digitalism to finances, such as blockchain, AI, and mobile banking, and assists the banks to adjust their financial objectives in line with environmental and social ones (Bhuiyan et al., 2024; Chen et al., 2023). Hidayat-ur-Rehman and Hossain (2024) indicate that FinTech has the potential to enhance sustainability because it stimulates green finance, low transaction cost, and reduced operational inefficiencies. Similarly, Raza and Bilal (2024) built evidence that FinTech can result in the corporate sustainability through the automatization of processes and decisions that are based on the data. However, as Romānova and Kudinska (2016) cautious, the future of FinTech is sustainable with the help of favorable governance frameworks and digital preparedness. The application of FinTech in the Islamic banking system can enhance economic inclusion, as well as ethical financial activities, which are informed by Shariah ideology (Hasan, Hassan and Aliyu, 2020). In conclusion, these articles tend to suggest that FinTech is a tool of change towards achieving sustainability in the banking sector.

H1: Islamic FinTech adoption has a significant positive impact on banks' overall sustainability performance.

2.3.2 FinTech and Bank Economic Performance

FinTech adoption in banking processes results in a significant improvement in the economic sustainability of an organization, which is mainly done by increasing productivity, cost efficiency, and profitability. Essential financial instruments are utilized in enabling quicker, safer, and customer-sensitive services by banks because of reducing administrative costs and multiplying sources of revenue (Khan et al., 2024). Hossain et al. (2023) have found that FinTech builds financial inclusion and extends the under loaded segments of the population and establishes new opportunities of growth. Similarly, Ali et al. (2024) discovered that the efficiency of operations and the satisfaction of customers with the utilization of FinTech are also more effective, which is translated into the increase in financial stability. On the other hand, Naz et al. (2023) also found the effect of bad digital infrastructure in developing markets may be repressing. FinTech in the Islamic banking sector helps in achieving cost-efficient financing which is Shariah-compliant, thereby encouraging value-creation and ethical investment in the long term. In this way, adoption of FinTech becomes a strategic asset of sustainable economic performance.

H2: Islamic FinTech adoption has a significant positive impact on banks' economic sustainability performance.

2.3.3 FinTech and Bank Performance

FinTech helps in environmental sustainability by facilitating green financial innovations, maximization of resource utilization and reinforcing environmentally sustainable investment processes. Digitalization helps cut down on paper consumption, increase energy efficiency, and make the banking activities eco-friendly (Zhang and Qian., 2023). Bhuiyan et al. (2024) showed that FinTech-supported green finance efforts have a major impact on minimizing the carbon footprint of banks through simplified carbon loan issuance to renewable energy programs. Likewise, Yan et al. (2022) discovered

that FinTech indirectly contributes to environmental performance in terms of green innovations and improved environmental risk assessment. Nonetheless, Martins et al. (2025) caution that the fast-online growth without sound regulation would escalate the number of e-waste and energy. Within the framework of Islamic banking, FinTech ensures the creation of environmentally friendly investment under ethical conditions in line with the idea of stewardship and balance. All of these facts indicate that FinTech is an essential tool that can help promote environmental sustainability in the banking industry.

H3: There is a strong positive influence of the Islamic FinTech adoption by banks on this environmental sustainability performance.

2.3.4 FinTech and Bank Social Performance

FinTech application is also linked to social sustainability by creating financial access, ensuring that more people can gain access to it, and empowering marginalized communities. According to Ngo and Nguyen (2024) FinTech reduces social inequalities because underprivileged groups can obtain low-cost financial products based on technology. Hossain et al. (2023) indicate that mobile and digital banking services are beneficial to the communities and are likely to make people trust financial institutions. Similarly, Nguyen, Tran and Ho (2022) have found out that FinTech increases equitable access to credits and social cohesion created by inclusive finance initiatives. FinTech aids the management of zakat and waqf in the Islamic context, making sure that funds are distributed in a transparent way and in a socially responsible manner (Fan et al., 2023). On the contrary, Lestari and Rahmanto (2023) observe that these social benefits might be narrowed by such factors as digital divides and low literacy rates. FinTech can generally be used to foster ethical inclusivity and social wellbeing in sustainable banking frameworks.

H4: The use of Islamic FinTech positively affects the social sustainability of banks, and at a high level.

3. Methodology

3.1 Research Design

The research design of this study is a quantitative mono-method study, which utilizes a survey research strategy to conduct an empirical investigation of the relationship among Islamic FinTech adoption and the sustainability performance of banks in Islamic Banking Institutions (IBIs) in Khyber Pakhtunkhwa, Pakistan. Quantitative method is appropriate to test a hypothesized relationship, quantify structural relationships among latent constructs based on PLS-SEM, and has been widely used in the context of FinTech and sustainability studies (Bonsu et al., 2025; Raza et al., 2024; Yan et al., 2022). The design is a cross-sectional; hence, the data were obtained at a single time to obtain statistical associations among the constructs. The design can be specifically used to evaluate the attitude towards adopting and sustaining technologies in organizations (Siddik et al., 2023).

3.2 Methodology and Procedures

The study utilized a deductive methodology, which was based on the EMT and the DCT to utilize the hypothesized effect of Islamic FinTech on sustainability performance. A structured questionnaire based on earlier tested

measurement scales was used to gather data (Siddik et al., 2023; Zheng et al., 2021; Almaqtari, 2024; Ali and Green, 2012). The survey was conducted on managers and employees of Islamic banks both physically and electronically. The data-collection was done after obtaining ethical approval and participation was voluntary and anonymous. The questionnaire was divided into two parts: demographic and the constructs pertaining to Islamic FinTech, and Sustainability Performance. The pilot testing was conducted on 30 respondents before full distribution to make sure the instrument was reliable and understandable (Raza and Bilal, 2024). Based on feedback some minor wording changes were introduced as a way of improving comprehension.

3.3 Population and Sample

The sample population included employees of Islamic Banking Institutions (IBIs) in Khyber Pakhtunkhwa. A purposive sampling method was used to obtain a total of 280 available answers of professionals such as branch managers, operational heads and financial analysts. The sample size is also consistent with the literature on the application of PLS-SEM that advocates the use of 150-300 cases to draw meaningful conclusions on structural modeling (Hair et al., 2021). The respondents were selected on the basis of their direct experience with digital banking activities and sustainability planning.

Table 1: Demographic Characteristics

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	197	70.4
	Female	83	29.6
Age (years)	20-30	78	27.9
	31-40	126	45.0
	41-50	59	21.1
	Above 50	17	6.0
Education Level	Bachelor's Degree	96	34.3
	Master's Degree	138	49.3
	MPhil/PhD	46	16.4
Job Position	Branch Manager	72	25.7
	Operations/Finance Officer	124	44.3
	IT/FinTech Specialist	49	17.5
	Other Administrative Roles	35	12.5

Bank Experience	Less than 5 years	68	24.3
	5-10 years	117	41.8
	11-15 years	63	22.5
	Above 15 years	32	11.4
Bank Type	Islamic Commercial Bank	182	65.0
	Islamic Window of Conventional Bank	98	35.0

The demographic findings indicate that the largest percentage of respondents were male (70.4) and aged 31-40 (45%), a comparatively young and active banking population in Khyber Pakhtunkhwa. Most of them had postgraduate qualifications (65.7%), which is a sign of good education pertinent to the concepts of FinTech and sustainability. The majority of respondents were working in operations or finance (44.3) and experience 5-10 years (41.8), which implies a high level of practical exposure to Islamic banking operation. Moreover, 65% worked in Islamic commercial banks, focusing on the institute representation that promotes the use of FinTech in Pakistan. The demographic structure in general suggests a highly qualified, knowledgeable, and context-sensitive sample capable of delivering sound knowledge regarding the association between the use of Islamic FinTech and the bank sustainability rates.

3.4 Measurement Scales

The constructs of Islamic FinTech Adoption and Sustainability Performance were measured using the modified versions of the scales that had already been tested and validated to achieve content validity and relevance to the context of the study. FinTech, reflects the employee's perception regarding how their bank implements technology-sanctioned financial solutions aligned with Islamic principles. Measurement items of this construct were selected based on Siddik et al. (2023) and Almaqtari (2024), which investigated the role of FinTech in enhancing sustainable and innovative banking performance. The respondents were to score statements on the extent of FinTech integration in their bank, the usefulness of these technologies in their opinion, and their effect on operational and strategic performance.

Sustainability Performance, however, is used to refer to the capability of the bank to attain a balanced development in both economic, environmental and social aspects without compromising US Islamic ethical standards. Its operations quantify the perceived results of sustainability efforts in relation to the aspects of environmental responsibility, economic stability, and social inclusiveness in Islamic banking practices. The measures of this construct were based on the items created by Zheng et al. (2021), Akter et al. (2018) and Raihan (2019), and they created and validated multidimensional indicators of financial-institution sustainability performance. The items are a measure of how much Islamic banks are helping conserve resources, community welfare, and long-term profitability using sustainable financial practices.

Each of the items was rated on a five-point weighted Likert scale with the 1 = Strongly Disagree up to 5 = Strongly Agree to respond to the statement about the outcomes of FinTech adoption and sustainability.

3.5 Data Analysis

The SmartPLS 4 data analysis tool was used to evaluate the measurement and structural model (Hair et al., 2021). Data screening in terms of missing values, multicollinearity and normality was conducted via SPSS 26 before the analysis. The Cronbachs Alpha, Composite Reliability (CR) and Average Variance Extracted (AVE) were used in determining reliability and validity whereas the HTMT ratio was used to determine the discriminant validity. Path coefficients and levels of significance were tested through bootstrapping (5,000 resamples) to assess the importance of specific hypothesis (Bonsu et al., 2025). The strategy of overall model quality was

determined using R^2 , Q^2 and Standardized root mean square Residual (SRMR).

Results

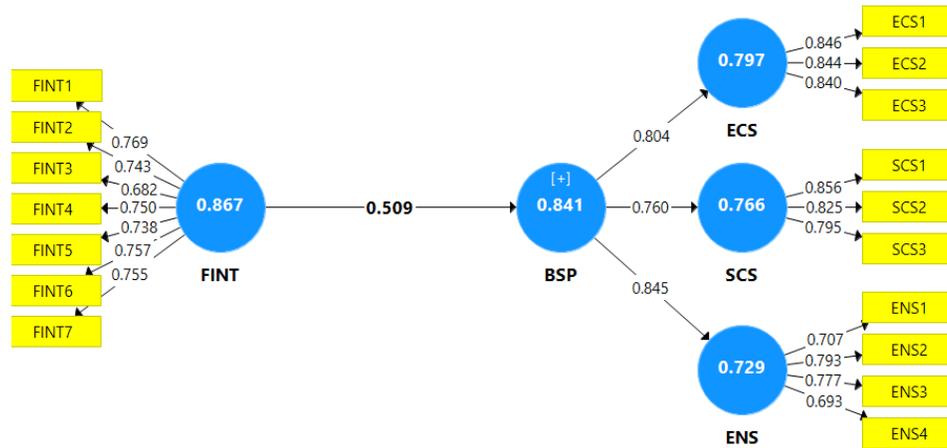


Figure 1: Outer and Inner Model

Assessment of Statistical Assumptions

Prior to studying the structural equation modeling, some statistical assumptions were verified in order to determine the validity and robustness of the data. First, Common Method Bias (CMB) was analyzed through a single-factor test developed by Harman, wherein the cumulative variance explained by one factor came below the 50% mark, which showed that CMB was insignificant (Podsakoff et al., 2012). Also, the full collinearity variance inflation factor (VIF) was evaluated, and all values were less than 3.3, indicating the lack of shared method variance (Kock, 2015). Second, the skewness and kurtosis

statistics were used to test data normality, which were within the acceptable range of +2 to evaluate the data as being approximately normally distributed and thus allowing PLS-SEM analysis, which does not assume strict multivariate normality (Sarstedt et al., 2019). Lastly, the VIF was used to measure multicollinearity, and the VIF of all the predictor constructs was lower than the cutoff of 5, which has no multicollinearity problems among independent variables (Hair et al., 2021). All these assessments helped to ensure that the dataset fulfilled all main assumptions of the structural modeling which guaranteed the readability and reliability of the results.

Table 2: Reliability and Validity

Variable	Indicator	Loading	T Statistics	Cronbach's Alpha	Composite Reliability	AVE
Economic Sustainability	ECS1	0.846	46.968	0.797	0.881	0.712
	ECS2	0.844	51.589			
	ECS3	0.840	40.590			
Environmental Sustainability	ENS1	0.707	17.929	0.729	0.831	0.553
	ENS2	0.793	32.993			
	ENS3	0.777	26.806			
	ENS4	0.693	18.670			

	FINT1	0.769	26.122			
	FINT2	0.743	21.410			
	FINT3	0.682	16.533			
FinTech	FINT4	0.750	29.790	0.867	0.896	0.551
	FINT5	0.738	20.224			
	FINT6	0.757	28.102			
	FINT7	0.755	25.046			
	SCS1	0.856	48.121			
Social Sustainability	SCS2	0.825	32.506	0.766	0.865	0.681
	SCS3	0.795	32.301			

Reliability and Validity

Measurement model was tested in order to determine the reliability and validity of constructs, which comprise FinTech Adoption, Economic Sustainability, Environmental Sustainability, and Social Sustainability. All of the indicators had an outerloading that was above the recommended value of 0.70, which validates acceptable indicators reliability (Hair et al., 2021). As indicated in Table 2, the item loadings of FinTech were 0.682-0.769 and those of Economic Sustainability were 0.840-0.846 showing that the observed variables were substantial and consistent measures of the latent constructs. Likewise, the loadings of Environmental Sustainability items were 0.693 to 0.793 and the indicators of Social Sustainability were 0.795 to 0.856- all higher than the minimum of convergent validation (Bonsu et al., 2025).

Internal consistency reliability was determined by the use of Cronbachs alpha and Composite Reliability (CR) values. Each construct achieved its Cronbach alpha ranging between 0.729 (Environmental Sustainability) and 0.867 (FinTech) and Composite Reliability scores greater than 0.80, which met the reliability criterion as suggested by Hair et al. (2021). These findings indicate the constructs were internally consistent and they had strong measurement reliability. In addition, the AVE of all constructs exceeded the 0.50 threshold and ranged between 0.551 and 0.712, which means that over half of the variance in every construct was explained by its indicators. This affirms acceptable convergence validity, which means that the items of every construct have a high level of common variance (Raza et al., 2024; Yan et al., 2022).

Table 3: Discriminant Validity

Fornell-Larcker criterion					HTMT-Ratio			
	ECS	ENS	FINT	SCS	ECS	ENS	FINT	SCS
ECS	0.844							
ENS	0.527	0.744			0.688			
FINT	0.388	0.423	0.743		0.435	0.5		
SCS	0.406	0.471	0.411	0.825	0.514	0.623	0.469	

Discriminant Validity

Both the Fornell-Larcker criterion and the HTMT ratio were applied to determine the discrimination validity, as advised by Hair et al. (2021). As indicated in Table 3 provided by the

FornellLarcker results, square root of the AVE of individual constructs (reported on the diagonal) exceeded the correlations of individual constructs with the other constructs, which proved the existence of shared variance between individual

constructs with their indicators as compared to those ones with other constructs. In particular, the diagonal coefficients of 0.844 (ECS) and 0.744 (ENS) and 0.743 (FinTech Adoption (FINT)) and 0.825 (SCS) were all positive, which was more than the relevant off-diagonal correlation coefficient. This trend shows that every construct of the model is empirically different than the others (Bonsu et al., 2025; Raza et al., 2024).

In addition, all HTMT ratios were lower than the conservative level of 0.85, which validates discriminant validity of constructs (Henseler et al., 2015; Hair et al., 2021). The construction values were 0.435 to 0.688 and these show that the

constructs are independent (conceptually and statistically). The comparatively moderate correlations of FinTech Adoption and the sustainability dimensions (HTMT = 0.469-0.500) indicate that FinTech is neither a separate measure of performance nor redundant, but a separate construct that is positively correlated with sustainability outcomes. Similarly, the medium relationships between the three dimensions of sustainability (ECS, ENS, and SCS) emphasize that all of them constitute a three-dimensional structure of bank sustainability, with each of them reflecting distinct but reciprocal elements (Yan et al., 2022).

Table 4: SEM Results

Path	Coefficient	STDEV	T Statistics	P Values	Confidence Interval		R Square	Q Square
					LCI	UCI		
FINT -> BSP	0.509**	0.046	11.052	0.000	0.413	0.598	0.459	0.103
FINT -> ECS	0.409**	0.039	10.615	0.000	0.333	0.480		
FINT -> ENS	0.430**	0.042	10.276	0.000	0.348	0.504		
FINT -> SCS	0.387**	0.043	9.055	0.000	0.300	0.466		

Note: ** p value < 0.05; BSP = Bank Sustainability Performance; FINT = FinTech

SEM Results and Hypotheses Testing

The structural model was evaluated with a PLS-SEM to measure the hypothetical associations between the Islamic FinTech Adoption (FINT) and the dimensions of the Bank Sustainability Performance (BSP)- ECS, ENS, and SCS. The model showed excellent explanatory power and predictive relevance with overall sustainability business performance R2 of 0.459, which implies that the model can explain about 45.9 per cent of the sustainable result variation. The Q2 value of 0.103 was as well above the zero mark, which proves the predictive accuracy and relevance of the model to out-of-sample forecasts (Hair et al., 2021).

According to the path coefficients in Table 4, the relationship between FinTech Adoption and all dimensions of bank sustainability is strong, and statistically significant. To be more specific, FinTech had the most impact on Environmental Sustainability (b = 0.430, t = 10.276, p < 0.001),

followed by Economic Sustainability (b = 0.409, t = 10.615, p < 0.001), Social Sustainability (b = 0.387, t = 9.055, p < 0.001), and general Business Sustainability Performance (b = 0.50). This is reflected in the narrowness of the confidence intervals (95% CI: LCI = 0.413, UCI = 0.598) and the consistent and strong parameter estimates on bootstrapped samples. All these findings confirm the hypothesis that an increased use of Islamic FinTech has a strong positive effect on the sustainability performance of banks (Bonsu et al., 2025; Raza et al., 2024).

The positive and impactful impact of FinTech Adoption on all dimensions of sustainability confirms the theoretical hypotheses of the EMT and the DCT. Innovation with the help of FinTech allows banks to digitalize their financial services, enhance resource efficiency, and better its social inclusion with Shariah-compliant digital services. The findings align with the previously performed research works by Yan et al. (2022) and

Siddik et al. (2023) who have determined that the utilization of FinTech enhances the level of green innovation, the efficiency of operations of financial institutions, and their positive impact on the environment. The conclusion is also in line with the findings leading Bonsu et al. (2025) to conclude that when enabled by a strong governance of information technologies, incorporation of FinTech in sustainability strategies yields quantifiable improvements in the environmental and economic performance.

Discussion and Conclusion

This article aims to examine the impacts of Islamic FinTech in sustainability performance of the Islamic banking institutions in Khyber Pakhtunkhwa region in Pakistan. According to the quantitative design and the analysis of PLS-SEM, the outcomes indicated that Islamic FinTech adoption make a significant contribution to economic, environmental, and social sustainability factors of the bank. These findings reiterate the phenomena of dynamic nature of digital financial innovation in Islamic banking sector whereby technology integration is supportive of ethical, inclusive and sustainable principles of Shariah finance.

The research results reveal that the adoption of FinTech has a high influence on the environmental sustainability. This means that the digital innovation enables the processes of resource optimization and green work. This conforms to the findings of Ahmed et al. (2022), and Chen et al. (2023), who stipulated that technology-enhanced financing models of green benefit the reduction in carbon and in operation disclosures. Similarly, Khan et al. (2024) found out that usability of FinTech helps to improve sustainable growth by reducing costs and expanding access to financial services. However, in contrast to Ahsan and Rahman (2020), who noted that the development of FinTech without ethical considerations might create system risks, the research points out that Islamic FinTech that can be developed on the premises of moral and Shariah values can ensure responsible innovation. They are also in line with Hossain et al. (2023) and Ali et al. (2024) since both articles have

underscored that FinTech integration can lead to financial inclusion and SDGs attainment in the developing world. As opposed to that, Nguyen et al. (2021) and Ryu et al. (2022) concluded that there is a regional-specific impact of the digital transformation on sustainability because of the technology infrastructure and regulatory preparedness. The findings of the given study serve as the continuation of that debate and prove that even in the context of the initial development of the Islamic FinTech system, such as that of Pakistan, regulated systems can give sustainability returns. The empirical validation of the significance of the Islamic FinTech as a tool that facilitated sustainability among the religious financial organizations is relevant in the literature. The results exemplify the notion that FinTechs adoption on top of the enhancement of operational efficiency, facilitates environmental stewardship and social responsibility, both elements of sustainable Islamic finance.

Theoretical Implications

The research contributes significantly to theory, inclusion of the EMT and DCT in the scenario of the Islamic banking and FinTech industry. The results widen the scope of EMT because they prove the impact generated upon the environment and social sustainability by technological innovation, the Islamic FinTech type. Ensuring that the adoption of FinTech positively contributes to all three aspects of the sustainability performance, the research empirically substantiates the idea that digital transformation could be the tool of ecological and organizational modernization. Additionally, with the help of DCT, the findings demonstrated the way in which banks establish dynamic technological capabilities, which allow them to respond to market and environmental changes on a continuous basis, thereby sustaining sustainable competitiveness. This theoretical synthesis will help broaden the scope of research on FinTech to faith-based finance and make Islamic FinTech appear as a technological and moral innovation that can aid sustainable development objectives SDGs.

Practical and Managerial Implication.

The research has certain implications which are practically implied to the bank managers, policy makers and regulators. The results will bring to the attention of managers the necessity to invest in FinTechs that do not contradict Shariah i.e. digital banking, mobile payment, and blockchain strategies to improve the performance of operations, resources use, and consumer trust. Through embracing digital tools that can be aligned with the Islamic ethics, the banks can become more profitable and responsible of the environment simultaneously. To policy makers, the findings indicate that there is a necessity to devise some regulatory schemes ensuring that innovation is enhanced without affecting the ethics and sustainability. The regulators are being encouraged to adopt the FinTech infrastructure, data security, and digital literacy programs in order to ensure that technology adoption promotes responsible and inclusive growth. All these would assist the financial institutions to design their digital strategies in accordance with the national sustainability principles and Islamic ethical demands.

Future Research Directions and Limitations.

Despite the fact that this study has been valuable, it has several limitations that open the way to new researches in the future. First, the study approach was a cross-sectional survey, which limits the causal conclusion of the Islamic FinTech usage with durability in the performance of banks. Since a longitudinal or mixed-method study would help reflect the changes in relationships and context over time, future research that would capture such nuances could be adopted. Second, the sample was limited to Islamic banking institutions in Khyber Pakhtunkhwa, thereby limiting the external validity of the results to other areas or nations with varying regulatory and technological contexts. The external validity of results would be improved by extending the sample to several provinces or international comparisons. Third, the article was based on self-reported perceptions, which are subject to response bias, so the inclusion of objective performance indicators or secondary financial data would enhance the accuracy of the measurement.

Research in the future must examine mediating and moderating factors, including green innovation, digital literacy, or institutional governance, to give a clearer insight into the effect of FinTech on sustainability. Moreover, further theoretical and policy implications can be found through comparative studies of Islamic and conventional banks or even various models of FinTech (e.g., blockchain and mobile banking). These researches would enhance the empirical basis of sustainable FinTech development in Islamic finance.

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