The Role of FinTech Adoption in Achieving Sustainable Performance of Banks: Mediating Effect of Digital Transformation and Moderating Roles of Transformational Leadership and Regulatory Support

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ABSTRACT

The rapid convergence of financial technologies (FinTech) and sustainability imperatives has redefined the operational landscape of modern banking institutions, particularly in emerging economies. As global organizations strive to meet Environmental, Social, and Governance (ESG) standards, understanding how digital tools such as FinTech contribute to sustainable performance has become a critical research priority. However, existing literature often examines FinTech adoption and sustainability in isolation, failing to explore the mechanisms through which digital innovation is transformed into sustainable outcomes. This study addresses this gap by investigating the mediating role of digital transformation in the relationship between FinTech adoption and sustainable performance, while also examining the moderating effects of transformational leadership and regulatory support. Grounded in the Dynamic Capabilities Theory, this research employed a cross-sectional, quantitative design targeting managerial-level employees in commercial banks across Pakistan. Data were collected through a structured questionnaire, with responses analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate the hypothesized relationships. Measurement models demonstrated high internal consistency, convergent validity, and discriminant validity across all constructs. The findings reveal that FinTech adoption significantly enhances sustainable performance and that digital transformation serves as a significant mediating mechanism in this relationship. However, contrary to theoretical expectations, the moderating roles of transformational leadership and regulatory support were not statistically significant. These results suggest that while technological adoption and internal transformation are crucial drivers of sustainability, contextual and institutional factors such as leadership and regulation may not uniformly enhance this process in all settings.

Keywords: *FinTech Adoption, Sustainable Performance, Digital Transformation, Transformational Leadership and Regulatory Support*

INTRODUCTION

In recent years, the accelerating convergence of finance and technology has prompted transformative shifts in how organizations operate, compete, and create value. Across industries, digital innovation is reshaping traditional paradigms of business management, decision-making, and sustainability practices. The Fourth Industrial Revolution, marked by digitalization, automation, and advanced data analytics, has made technological adaptability a prerequisite for organizational resilience and growth. Financial technologies (FinTech), once confined to niche startups, are now embedded across mainstream sectors, prompting scholars and practitioners alike to re-evaluate institutional capacities for embracing innovation in an ethically responsible and strategically sustainable manner (Zhou et al., 2023). As organizations navigate this digital frontier, debates persist over the internal and external enablers that facilitate effective technological integration while ensuring sustainable performance outcomes. Amid these transitions, leadership agility, policy frameworks, and digital infrastructure have emerged as critical focal points in contemporary management research. Thus, it becomes imperative to understand not just the adoption of new technologies but the organizational ecosystems that condition their success. In this context, the roles of leadership, regulatory guidance, and transformative capacity warrant deeper exploration particularly in relation to how they converge to shape sustainability-focused digital evolution. This study situates itself within this evolving discourse, seeking to bridge conceptual and practical dimensions of technological change.

Recent research highlights the increasing penetration of FinTech solutions in enterprise-level financial systems, driven by the need for operational efficiency, data transparency, and customer-centric services (Alam et al., 2023). While the functional benefits of FinTech adoption such as cost reduction, improved access, and real-time analytics are well documented, its alignment with sustainability goals remains underexplored. Digital transformation, particularly when embedded within a broader sustainability agenda, has been recognized as a catalyst for long-term organizational performance (Nguyen et al., 2022). Leadership characteristics, especially transformational leadership, have also garnered attention for their role in motivating technological change, fostering innovation, and enhancing organizational learning (Park & Park, 2022). Regulatory support is increasingly seen as not merely a compliance mechanism but a facilitator of structured innovation, particularly in highly dynamic industries. Yet, the complex interplay between these dimensions' technology, leadership, regulation, and sustainability remains theoretically fragmented and empirically underdeveloped.

As global economies undergo digital upheavals, sustainability has emerged as a concurrent imperative alongside innovation. The United Nations' 2030 Agenda and ESG (Environmental, Social, and Governance) metrics now heavily influence corporate strategy, requiring firms to balance technological modernization with social and environmental responsibility (World Economic Forum, 2023). In this dual pursuit, financial technologies offer transformative potential, yet their adoption varies dramatically across industries and geographies. In emerging economies, for instance, FinTech adoption is hampered by infrastructural bottlenecks, policy ambiguities, and a lack of digital literacy (Rahman et al., 2022). Meanwhile, corporations in highly regulated sectors face additional scrutiny regarding the ethical and environmental implications of digital transformation. Nationally, institutions are under pressure to comply with green finance directives and adopt circular economic practices, compelling organizations to seek innovative routes toward sustainable performance. Additionally, leadership capacity has emerged as a limiting factor in successfully integrating advanced digital systems into legacy business models. Without visionary and transformational leadership, even the most sophisticated digital tools fail to yield sustainable outcomes. Thus, understanding how firms can strategically align FinTech with long-term

sustainability while navigating regulatory constraints and enabling organizational change constitutes a pressing global and regional concern, particularly in the context of developing markets.

Despite growing academic interest in digital finance and sustainability, the current literature largely addresses these domains in isolation. Most studies investigating FinTech focus either on user adoption from a consumer perspective or on operational outcomes such as cost-efficiency and service delivery (Yang et al., 2022). However, limited scholarly attention has been given to how FinTech adoption contributes to broader sustainable performance goals at the organizational level. More critically, while digital transformation is recognized as a driver of sustainability, the mechanisms through which FinTech catalyzes this transformation remain under-theorized. Leadership is frequently cited as a determinant of innovation readiness, yet empirical studies rarely examine how transformational leadership fosters FinTech-induced digital maturity in ways that promote sustainability (Kim & Kim, 2023). Regulatory support often treated as a contextual variable is seldom incorporated into holistic models that explore its role in enabling or moderating innovation and sustainability pathways. This gap is especially pronounced in developing economies, where institutional voids and leadership constraints magnify the challenges of implementing sustainable digital strategies. The fragmented nature of existing research overlooks the synergistic potential of leadership, regulation, and digital transformation in translating FinTech capabilities into sustainable performance. To address this gap, this study proposes an integrated framework that positions digital transformation as a mediating mechanism through which FinTech adoption, under the influence of transformational leadership and regulatory support, contributes to sustainable organizational outcomes. By doing so, it offers a more comprehensive understanding of how firms can simultaneously pursue innovation and sustainability.

The urgency of addressing climate change, social equity, and responsible governance has elevated sustainable performance from a corporate aspiration to a strategic necessity. Companies are increasingly evaluated not only on financial returns but also on their capacity to generate long-term societal and environmental value (Kaur & Kaur, 2023). In this context, digital innovations such as FinTech are more than operational tools they are strategic levers for achieving integrated sustainability outcomes. Yet, the success of these innovations depends on more than technological sophistication; it hinges on the organizational ecosystem leadership, culture, and policy context in which they are deployed. In many economies, regulatory ambiguity or absence of supportive frameworks has stifled innovation or led to unsustainable practices. Similarly, leadership that fails to articulate a transformative vision may inhibit meaningful digital uptake. These failures translate into missed opportunities for competitiveness, environmental stewardship, and social contribution. Therefore, exploring how FinTech adoption intersects with transformational leadership and regulatory support to drive digital transformation offers both theoretical and practical relevance. Unpacking this nexus can inform policy design, guide corporate strategy, and equip leaders with the insights needed to harness digital capabilities for sustainable development. Addressing this multidimensional problem is not merely timely it is essential.

This paper makes a new contribution in the form of an integrated model that can describe how sustainable performance could be improved due to the adoption of FinTech by the use of digital transformation managed through transformational leadership and regulatory support. The study contributes beyond a hypothetical framework, as it establishes there is a medium linking the two concepts, the digital transformation, and it is based on this path that the two enabler concepts of leadership and regulation have been addressed to provide practical means of sustaining the digital evolution changes. It also contributes to the existing literature in that attention to the organizational-level dynamics in the context of developing economies is more of an underserved area of study. Based on the Dynamic Capabilities Theory, FinTech adoption, leadership, and regulation usage are conceptualized in this study as organizational capabilities interchangeably related to drive digital transformation as a critical dynamic capability in achieving

sustainable performance. The model underlines the response by firms to external changes by reconstructing internal competencies. This theoretical lens corresponds to the built-in model of the study as it provides the solid basis to examine the way adaptive leadership and institutional support can foster the potential to leverage the FinTech to help sustainability over the long term. The results will have implications on the digital policy sector, leadership, and sustainability plans in industries.

Theoretical Foundation

Dynamic Capabilities Theory (DCT), rooted in strategic management research, offers a powerful lens for understanding how organizations adapt and thrive amidst turbulence and technological disruption. DCT was the capacity of the firm to integrate, develop, and rebuild and mold both internal and external competences using the change in environments (Teece et al., 1997). Building on evolutionary thought in economics (Nelson & Winter, 1982), the theory further develops the resource-based view of the firm to see competitive advantage as arising not only out of the structure of assets, but out of processes and routines in an organization that lead to continuous renewal of the organization. At its inception, the theory has continued to develop along different scholarly rivers. A powerful flow focuses on tripartite micro foundations of sensing, seizing, transforming that brings the notion of how companies sense opportunities, marshal forces, and restructure their structure to maintain advantage (Kump et al., 2018; Teece, 2007). The other stream which is characterized in more functional specific studies operationalizes DCT through the amenability or best practice routines that includes innovation cycles or absorptive capacity mechanisms in dynamic industries notably (Eisenhardt & Martin, 2000).

The recent literature has attempted to find a synthesis, offering evolutionary models that combine the various positions organizational routines, managerial entrepreneurship, and improvisational capability conceptualizing the evolution of dynamic capabilities as a spiral process of adaptation, innovation, and response (Arndt et al., 2023). This integrative view highlights DCT's applicability in contemporary contexts characterized by digital complexity and rapid change. The relevance of Dynamic Capabilities Theory to contexts such as FinTech adoption and sustainable performance lies in its focus on how organizations reconfigure competencies in the face of digital disruption. In digital ecosystems, firms must continuously sense technological shifts, seize digital opportunities, and transform legacy systems into sustainable, future-oriented configurations. Recent empirical studies confirm DCT's predictive power in digital firms, dynamic managerial capabilities as micro foundations underpinning broader dynamic capabilities have been shown to facilitate innovativeness in digital enterprises (Heubeck & Meckl, 2022). Complementing this, knowledge-based dynamic capabilities research demonstrates how firms leverage experiential learning, absorptive routines, and governance mechanisms to foster entrepreneurial orientation and long-term performance (e.g., entrepreneurial orientation or sustainability outcomes) in highly dynamic sectors. Within the integrated framework of this study, DCT logically supports the interplay of FinTech adoption, leadership, regulation, and sustainable performance by portraying the firm as an evolving organism capable of reconfiguring internal and external assets to realize sustainable digital transformation.

Hypotheses Development

In the wake of global sustainability challenges and rapid technological advancement, businesses are under increasing pressure to embed environmental, social, and governance (ESG) values into their core strategies. Against this background, the advent of financial technologies (FinTech) has been cherished not only as a tool to promote operational efficiencies, but it has also been dubbed as a game changer in terms of sustainability in business. FinTech stretches into a wide range of digital propositions, like blockchain-

based transactions, algorithmic lending, existing time exertion of analyses and green financing platforms. By facilitating the optimization of operations, the minimum use of resources, increasing fiscal inclusion and raising the degree of transparency, such innovations provide companies with the opportunity to become sustainable in terms of performance outcomes (Gozman et al., 2022). Moreover, the new study pointed out that FinTech was likely to expand the availability of the financial services, make them more democratic, and can also support sustainable and transparent supply chains promoting the economic and ecological sustainability (Tian et al., 2023). It could also adopt data centered models of decision making via FinTech that can be applied in line with long run planning of sustainability within any business organization and in turn leading to its strategic character within the modern place of business information.

From a theoretical standpoint, Dynamic Capabilities Theory (DCT) provides a fitting lens to interpret how FinTech adoption facilitates sustainability. The dynamic capabilities can be conceptualized as the opportunity to sense and capitalize on the opportunity strategically and the capability of a company to turn internal capabilities into strategic resourcing to sustain competitive advantage in the turbulent environment (Teece et al., 1997). By making FinTech an operational tool oriented towards strategic assets, one supports the expansion of these capabilities by allowing the firm to rapidly adapt to environmental changes, routinely redesign business activities, and build adaptive routines according to the ESG standards (Heubeck & Meckl, 2022). This claim could be backed by the recent empirical evidence which indicates that an increase in the share of the strategic framework of firms attaching importance to FinTech usage is correlated with a rise in claims of success in environmental compliance, the practices of social responsibility, and the quality of governance (Zaid, 2025). It would be rational to hypothesize, taking into account this theoretical background and the current empirical data, that companies who adopt FinTech methods have greater chance of fulfilling sustainability.

H1: FinTech adoption is positively associated with sustainable performance.

Recent empirical research indicates that the adoption of FinTech alone does not automatically translate into enhanced sustainable performance; rather, the outcomes often depend on whether organizations systematically integrate FinTech into their broader digital infrastructure. Commercial banks in Pakistan revealed that FinTech adoption significantly influences sustainable performance only when digital transformation processes are in place, meaning that technological tools by themselves are insufficient unless embedded within cohesive digital strategies (Khan et al., 2025). The same holds true in other relevant research on emerging market setups where digitalized transformation assists companies to translate FinTech-related investments into practical ESG benefits expressed through optimized internal processes and data analytics, transparent business operations (Su et al., 2023; Zaid, 2025). The results support the idea of Dynamic Capabilities Theory that sustainable advantage lies in the ability of a firm not only to implement digital tools, but to remodel business process and that the process of digital transformation is the process through which FinTech can deliver environmental, social, and governance performance.

Theoretically, Dynamic Capabilities Theory posits that organizations derive enduring performance through processes of sensing opportunities, seizing them, and transforming internal routines (Teece, 1997; Eisenhardt & Martin, 2000). Digital transformation constitutes the transformation pillar serving as the vehicle that integrates FinTech into daily operations and strategic workflows. Scholars have shown that digital transformation strengthens ESG outcomes via enhancements in green innovation capability, operational excellence, and corporate social responsibility routines (Su et al., 2023; Wei & Zheng, 2024). Thus, under this theoretical framing, digital transformation is not simply another variable; it is the dynamic process by which FinTech capabilities are converted into sustainable performance. Building on

this interconnected logic, empirical and theoretical work supports the proposition that the effect of FinTech on sustainability is mediated by an organization's capacity for digital transformation.

H2: Digital transformation mediates the relationship between FinTech adoption and sustainable performance.

In organizational environments characterized by rapid digitalization and innovation, the capacity of firms to translate FinTech adoption into cohesive digital transformation efforts often hinges on leadership style especially transformational leadership. Transformational leaders, known for their inspirational motivation, intellectual stimulation, idealized influence, and individualized consideration, are uniquely positioned to cultivate shared visions and strategic alignment needed for comprehensive digital change (Bass & Riggio, 2006; Northouse, 2018). Empirical evidence highlights that such leaders play a pivotal role in overcoming resistance to change and mobilizing employee commitment to adopt digital initiatives (Özkan Alakaş, 2024; Özgül & Zehir, 2023). Within the context of FinTech adoption, transformational leadership may enhance organizational receptivity to technology by articulating a compelling digital vision, reinforcing learning behaviors, and motivating adaptive routines. From a dynamic capabilities' perspective, transformational leadership can amplify the firm's sensing and seizing capacities by shaping culture and context, enabling digital transformation to occur more effectively when new financial technologies are adopted.

Theoretically, Dynamic Capabilities Theory emphasizes that sustainable competitive advantage is derived from a firm's ability to sense opportunities, seize them, and transform internal processes (Teece, 1997; Eisenhardt & Martin, 2000). While FinTech adoption provides the tools for sensing and seizing, the transformational component of digital transformation hinges on leadership that fosters change-agility and innovation orientation. Contemporary literature supports the proposition that digital transformational leadership not only drives digital transformation directly, but also interacts with technology adoption to strengthen its effects (Procedia Computer Science, 2024; Emerald Insight, 2024). When leaders communicate a clear digital strategy and foster a learning-oriented culture, employees are more likely to integrate FinTech tools into operational routines, accelerating digital transformation (Ramadan et al., 2023). Thus, under high levels of transformational leadership, the connection between FinTech adoption and successful digital transformation should be stronger than under low levels of such leadership.
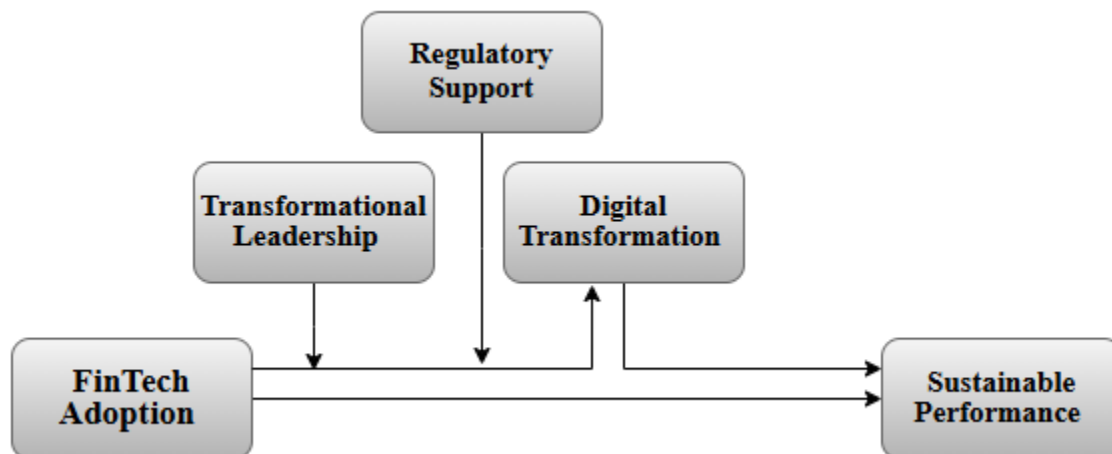
H3: Transformational leadership positively moderates the relationship between FinTech adoption and digital transformation.

The rapid diffusion of FinTech solutions has spotlighted the role of regulatory frameworks in determining whether technological adoption translates into comprehensive digital transformation. Although the FinTech provides companies with one of the most efficient payment processing tools, data analytics, and green finance, its implementation into the workflows of organizations is usually determined by the clarity, adaptability, and convenience of regulatory situations (Feyen et al., 2021; Klman, 2025). Specifically, the policy inventions including the regulatory sandboxes initiatives minimize uncertainty and promote experimentation and save collaborative activity between regulators and companies (Kalm, 2025). Empirical studies have highlighted that jurisdictions with favorable, proactive regulatory environments are more appealing to FinTech investment, and they also underpin the swifter migration of isolated adoption to essential change to the complete digital transformation (Fenwick et al., 2024; Reuters, 2024). In dynamic capabilities theory, regulatory plays an enabling institutional role that increases the force of the transformation of firms-by creating less friction and defining the boundaries. Risk-based methods, as well as growth-targeted trajectories that clear up confusion and provide open regulatory systems, enable

the process of reorganizing internal operations and integrating FinTech into general digital strategies by organizations in a more efficient way.

Theoretically, dynamic capabilities would have it that the ability of organizations to change is premised on the capacity by the firm to sense, seize and transform organizational routines adopting to changing settings (Teece, 1997; Eisenhardt & Martin, 2000). The stages of the model of digital transformation as the process of seizing and transforming are buffered by regulatory support that addresses the readiness of firms to invest in digital transformation, and, external conditions of the FinTech solutions integration. Recent literature supports this view: for SMEs and banks in emerging markets, regulatory clarity has been shown to strengthen the link between technology adoption and digital transformation outcomes (Succurro et al., 2025; Thottoli, 2024). When regulators reduce ambiguity and create safe innovation zones, organizations are more likely to pursue and realize digital restructuring. Under conditions of high regulatory support, the positive effect of FinTech adoption on digital transformation is expected to be substantially enhanced.

H4: Regulatory support positively moderates the relationship between FinTech adoption and digital transformation.

METHODOLOGY

This study adopts a quantitative, cross-sectional research design, which is well-suited for empirically examining the relationships among FinTech adoption, digital transformation, transformational leadership, regulatory support, and sustainable performance within organizational contexts. A cross-sectional approach allows for the collection of data from a defined population at a single point in time, making it appropriate for exploring the hypothesized structural relationships without the need for longitudinal tracking (Creswell & Creswell, 2022). Given the study's emphasis on testing theoretical relationships using statistical modeling, a quantitative paradigm ensures objectivity, replicability, and the ability to generalize findings within similar settings.

The target population for this research comprises managerial-level employees within private commercial banks operating in Pakistan, particularly those involved in digital finance, innovation, or sustainability-related roles. The population is chosen as it has a direct interest in the FinTech solutions and plays a strategic role in digital and sustainable transformation in the banking industry. Banks are key points of FinTech integration and are the targets of new regulation regimes as well as digitalization requirements (Yousaf et al., 2023). This group is being discussed to obtain pertinent information concerning the impact of leadership and regulation on the actual practice of FinTech and its role in supporting the sustainability goals. A purposive sampling method is applied to focus on the experience of such professionals as managers, digital officers, and IT executives involved in the work on FinTech implementation and the sustainability movement. This non-probability sampling method will guarantee that respondents with lots of information are included and this addresses them on the basis of their suitability in relation to the conceptual model of their study. The sample size is to be determined using Item Response Theory (IRT) because it is well suited to analyze both the item difficulty and the respondent ability as well as the discrimination parameters, and it is recommended to be used in Likert-scale survey research in an organization (Embretson & Reise, 2013). As shown by Linacre (2022), 300-500 respondents are sufficient to identify a good structural model with multiple constructs as latent variables and the parameters will be stable. The minimum sample size recommended also carries, 10-times rule that is more than applied in Partial Least Squares Structural Equation Modeling (PLS-SEM). The method of collection of data involves a structured questionnaire that is administered on a physical and electronic basis. The study will use SPSS and SmartPLS 4 to SEM. The fundamental difference could be attributed to the reason as to why the dataset should be analyzed using SPSS in the initial stages of data screening and univariate tests, whereas the robustness of SmartPLS lies in capacity to handle complex models and include mediating effects and moderating variables, the small-to-medium sample size and departures of non-normal data in conducting analyses thereof (Hair et al., 2022).

Measurement

All constructs in this study are measured using standardized scales adapted from prior validated studies, each measured on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. FinTech adoption items are adapted from Khan et al. (2025), digital transformation from Zaid (2025), transformational leadership from Özkan Alakaş (2024), regulatory support from Succurro et al. (2025), and sustainable performance from Su et al. (2023). The use of established instruments enhances content validity and allows for theoretical replication across settings.

DATA ANALYSIS
Factor loadings

Table 1: Regression weights

Variables	Items	DT	FA	RS	SP	TL
Digital Transformation	**DT2**	0.791				
	DT3	0.769				
	DT4	0.800				
	DT5	0.869				
	DT6	0.805				
	DT7	0.821				
FinTech Adoption	**FA1**		0.883			
	FA2		0.871			
	FA3		0.851			

	FA4	0.825		
	FA5	0.859		
	FA6	0.890		
	FA7	0.806		
	FA8	0.904		
Regulatory Support	RS1		0.836	
	RS2		0.863	
	RS3		0.833	
	RS4		0.900	
	RS5		0.915	
	RS6		0.937	
	RS7		0.886	
	RS8		0.894	
Sustainable Performance	SP1			0.829
	SP2			0.812
	SP3			0.822
	SP4			0.869
	SP5			0.853
	SP6			0.803
Transformational Leadership	TL1			0.866
	TL2			0.905
	TL3			0.871
	TL4			0.910
	TL5			0.843
	TL6			0.868

Factor loadings represent the degree to which each observed item reflects its underlying latent construct, serving as critical indicators of convergent validity and construct reliability in structural equation modeling. In the confirmatory factor analysis (CFA), loadings of 0.70 or above are usually deemed as strong since that kind of loading implies that the latent variable accounts at least 49 percent of variance in the item (Hair et al., 2022). To be exploratory, higher values and over 0.40 can still be acceptable but increasing values increases the strength of the construction measurement and model interpretation. Factor loadings form the basis of measuring internal consistency and providing a guarantee that the items of certain measurement correspond both theoretically and empirically to the constructs in question (Kline, 2023). The findings reproduced demonstrate that all indices of the variables observed within five constructs such as Digital Transformation, FinTech Adoption, Regulatory Support, Sustainable performance, and Transformational leadership are above 0.70, which is the desired maximum score. The questions measuring FinTech Adoption (e.g., FA1 = 0.883, FA8 = 0.904) and Regulatory Support (e.g., RS6 = 0.937, RS5 = 0.915) led to such strongly looking factor loadings, which proves the high level of reliability. Something similar can be said about the items used in Digital Transformation and Transformational Leadership, which loads above 0.79 and 0.84, respectively, in support of construct validity. Based on these findings, all factors are strongly related to its corresponding latent variable and it is neither practically nor theoretically sensible to exclude items.

Table 2: Reliability and Validity Statistics

Variables	Cronbach's alpha	(rho_a)	(rho_c)	(AVE)
Digital Transformation	0.895	0.897	0.919	0.656
FinTech Adoption	0.950	0.955	0.958	0.742
Regulatory Support	0.963	0.982	0.966	0.781
Sustainable Performance	0.911	0.912	0.931	0.692
Transformational Leadership	0.940	0.942	0.952	0.770

Internal consistency reliability and convergent validity are essential for ensuring that latent constructs are measured accurately and consistently. Cronbach Alpha, rho A and Composite Reliability (rho C) measures the homogeneity of items within a given construct and this can be related to the degree of associations between items. The acceptable thresholds are typically 0.70 or above, which denotes consistent measures scales (Hair et al., 2022; Kline, 2023). Likewise, Average Variance Extracted (AVE) shows the extent of variance to which a construct is tapping compared to the variance that is driven by the measurement error, whereby 0.50 or larger depicts an adequate convergent validity (Fornell & Larcker, 1981; Sarstedt et al., 2022). All of the constructs reported values that are higher than the recommended thresholds. FinTech Adoption demonstrates a high internal consistence in the same measure with a Cronbach Alpha of 0.950 with rho_A 0.955, and rho_C 0.958 recorded and is represented by a good AVE of 0.742 and has very good reliability and convergent validity. On the same note, Regulatory Support and Transformational leadership also records higher levels of measurement properties with the AVE standing at 0.781 and 0.770 respectively. Digital Transformation and Sustainable Performance also exceed the minimum, having Cronbach Alpha greater than 0.89 and AVEs way over 0. 50. These findings confirm the psychometric strength of the constructs and support their suitability for structural modeling in the present study.

Discriminant Validity

Table 3: HTMT Ratio

Variables	DT	FA	RS	SP	TL
Digital Transformation					
FinTech Adoption	0.429				
Regulatory Support	0.089	0.097			
Sustainable Performance	0.516	0.646	0.044		
Transformational Leadership	0.487	0.582	0.075	0.608	

Discriminant validity assesses the extent to which constructs in a structural model are empirically distinct from one another. Heterotrait-Monotrait ratio of correlations (HTMT) is a newer method and is more recommended that the old method of determining ratio of any test collapse like Fornell-Larcker criterion or collusion of cross-loadings (Henseler et al., 2015). Discriminant validity is measured by the HTMT ratio, which compares the mean correlations between variables, with a range below 0.85 implying strict discriminant validity criterion and a range below 0.90 indicating a satisfactory validity criterion using more liberal criterion (Franke & Sarstedt, 2019; Hair et al., 2022). The values of HTMT concluded in the results table lie under acceptable limits. All the values are lower than the conservative threshold of 0.85. In a comparable fashion, there are powerful discriminant validity results between Digital Transformation and the other constructs (e.g., 0.429 with FinTech Adoption, 0.516 with Sustainable Performance, and 0.487 with Transformational Leadership). Construct distinctiveness is also supported by the values between Regulatory Support and the other constructs (less than 0.10 across the board). These results

collectively confirm that the latent constructs exhibit robust discriminant validity supporting the structural model's appropriateness for hypothesis testing and theory building.

Table 4: Model Fitness Indicators

	Saturated model	Estimated model
SRMR	0.052	0.060
d_ULS	1.625	2.168
d_G	1.065	1.081
Chi-square	1860.626	1879.579
NFI	0.825	0.823

The model fit indices indicate that the structural model demonstrates an acceptable fit to the data. The standardized root means square residual (SRMR) values for both the saturated (0.052) and estimated models (0.060) are below the recommended threshold of 0.08, indicating good model fit (Hair et al., 2022). Additionally, the discrepancy values (d_ULS and d_G) show minimal differences between the models, further supporting model adequacy. The chi-square values are high, which is typical for large samples, and the normed fit index (NFI) values of 0.825 and 0.823 meet the minimum threshold of 0.80, suggesting an acceptable overall model fit.

Table 5: R square

	R-square	R-square adjusted
Digital Transformation	0.247	0.235
Sustainable Performance	0.434	0.430

The R-square values indicate the proportion of variance explained by the predictors in the structural model. For digital transformation, an R-square of 0.247 suggests that fintech adoption, transformational leadership, and regulatory support together explain 24.7% of its variance, which is considered moderate (Hair et al., 2022). Similarly, the R-square for sustainable performance is 0.434, indicating that digital transformation and fintech adoption account for 43.4% of the variance in sustainable performance reflecting a substantial explanatory power. The adjusted R-square values are slightly lower, which is expected as they account for the number of predictors and the sample size, confirming model consistency.
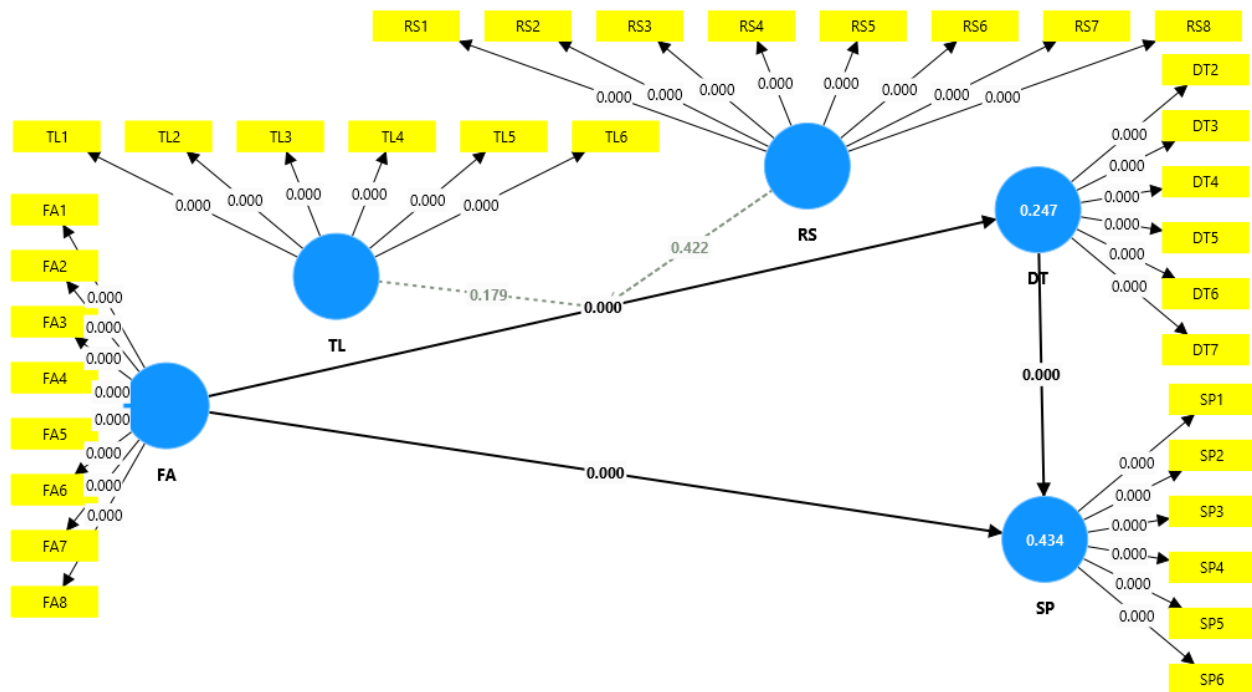
Table 6: Hypotheses Results

	Original sample	Sample mean	Standard deviation	T statistics	P values
FinTech Adoption -> Sustainable Performance	0.505	0.504	0.041	12.176	0.000
FinTech Adoption -> Digital Transformation -> Sustainable Performance	0.063	0.063	0.022	2.878	0.004
Transformational Leadership x FinTech Adoption -> Digital Transformation	-0.071	-0.068	0.053	1.344	0.179
Regulatory Support x FinTech Adoption -> Digital Transformation	0.066	0.058	0.082	0.804	0.422

The hypothesis testing results reveal mixed support for the proposed relationships. The direct effect of fintech adoption on sustainable performance is statistically significant ($\beta = 0.505$, $t = 12.176$, $p < 0.001$), confirming a strong positive relationship. This finding aligns with previous literature suggesting that the integration of financial technologies enhances organizational efficiency and environmental outcomes (Al-Okaily et al., 2022). Additionally, the indirect effect of fintech adoption on sustainable performance through digital transformation is also significant ($\beta = 0.063$, $t = 2.878$, $p = 0.004$), providing empirical support for the mediating role of digital transformation. This implies that digital transformation serves as a partial pathway through which fintech adoption enhances sustainability outcomes, validating the mediating hypothesis. However, the moderating effects of transformational leadership and regulatory support were not supported. The interaction term for transformational leadership and fintech adoption on digital transformation was statistically insignificant ($\beta = -0.071$, $t = 1.344$, $p = 0.179$), indicating that transformational leadership does not significantly strengthen or weaken the effect of fintech adoption on

digital transformation. Similarly, the interaction between regulatory support and fintech adoption did not yield significant results ($\beta = 0.066$, $t = 0.804$, $p = 0.422$). These results suggest that neither regulatory support nor transformational leadership meaningfully alters the fintech–digital transformation link in the sampled context.

DISCUSSION

The results of the hypothesis testing in this study provide valuable insights into how FinTech adoption influences sustainable performance within banks, particularly through the mediating role of digital transformation. However, the findings also challenge prevailing theoretical assumptions regarding the moderating effects of transformational leadership and regulatory support, prompting a nuanced reflection on both empirical and contextual grounds.

Theoretical anticipations are supported by the significance and the powerful relationship between FinTech adoption and sustainable performance (H1), which is consistent with the available empirical studies. According to Dynamic Capabilities Theory, FinTech is not only given the capabilities of firms to sense and take opportunities in the market, but it also facilitates organizational transformation (Teece, 2007). The finding confirms the opinion that FinTech (strategically integrated) can be both an efficiency generator, but also a driver of long-term sustainability, and one element of such sustainability is environmental and social performance (Gozman et al., 2022; Zaid, 2025). FinTech implementation seems to help make it easier to be transparent, inclusive, and operationally efficient, which is all factors that should lead to more sustainable outcomes because of the rising pressure facing Pakistani commercial banks to comply with ESG standards and mandates concerning digital innovation (Khan et al., 2025). Also, this fact is in line with those that indicate digital financial solutions can enhance governance and compliance in strictly controlled industries (Tian et al., 2023). This relationship is of importance to the overall extent to which FinTech can influence corporate strategies to be ESG-oriented within an emerging market environment.

The second hypothesis (H2) that sought to assert that digital transformation was a mediator between the FinTech adoption and sustainable performance also held water. The positive and significant indirect impact allows to confirm theoretically postulated propositions of the Dynamic Capabilities Theory when transformation is viewed as the principal capability allowing the reconfiguring of resources (Eisenhardt & Martin, 2000; Teece et al., 1997). This result reinforces recent findings suggesting that digital transformation is the operational conduit through which FinTech-driven tools are embedded into core processes enhancing sustainability-related capabilities (Su et al., 2023). Nguyen et al. (2022) indicates that FinTech adoption without accompanying digital restructuring may limit the extent of sustainability impact. Digital transformation enables the reengineering of workflows, automation of compliance procedures, and data-driven environmental management, all of which are prerequisites for sustained ESG outcomes (Wei & Zheng, 2024). Digital transformation functions as a dynamic mechanism through which banks in emerging economies convert digital investments into measurable sustainability gains.

Contrary to expectations, the moderating effect of transformational leadership on the relationship between FinTech adoption and digital transformation (H3) was not supported. While transformational leadership has been widely theorized as a catalyst for organizational change particularly in facilitating innovation and overcoming resistance (Bass & Riggio, 2006; Özkan Alakaş, 2024) its lack of significant moderating impact in this study suggests context-specific dynamics. One plausible explanation is that in highly regulated banking environments, strategic technology adoption may be more structurally or institutionally driven than leadership-driven. That is, banks may adopt and implement FinTech solutions based on

regulatory pressure or competitive necessity, rather than internal visionary leadership (Kim & Kim, 2023). Alternatively, the leadership behaviors measured in the study may not have sufficiently reflected the digital-specific competencies required to mobilize FinTech-led transformation such as digital visioning, data fluency, or platform thinking (Ramadan et al., 2023). It is also possible that middle managers in the sampled institutions lack the autonomy to significantly influence large-scale digital shifts, limiting the observable effect of transformational leadership. These considerations call for more granular investigations into digital leadership and hierarchical dynamics in banking institutions.

The hypothesis on the positive moderating role of regulatory support on the relationship between FinTech adoption and digital transformation (H4) was not accepted returning another surprising result. It has been postulated that, on the one hand, regulatory sandboxes are prioritized in enhancing the faster transition (Fenwick et al., 2024), and on the other hand, clear and enabling regulatory frameworks can speed up the digital transformation considerably (Feyen et al., 2021; Kalm 2025). However, he minimal moderation effect in that regard can be attributed to the subtlety of regulatory conditions in growing economies such as Pakistan. In some cases, formal policies that support digital finance might be in place; however, they might be erratic, vague, or lacking the proactive idea in promoting innovation. Companies that view regulatory procedures as inhibiting or based on compliance as opposed to strategic innovation drivers can be subject to the feeling that they are being constrained and forced to comply with rules and regulations imposed by the relevant agencies and authorities in question (Thottoli, 2024). Another explanation may lie in a potential mismatch between the perceived and actual influence of regulatory institutions respondents may endorse the presence of regulatory structures without witnessing their practical impact on organizational transformation efforts. These findings highlight the complexity of institutional environments and suggest that regulatory support alone may not suffice unless it is accompanied by effective enforcement, stakeholder collaboration, and innovation incentives.

LIMITATIONS AND FUTURE DIRECTIONS

Despite the study's robust theoretical grounding and empirical rigor, several limitations must be acknowledged, which may influence the interpretation and generalizability of the findings. The use of a cross-sectional research design limits the ability to infer causal relationships among variables. Although statistical associations were observed, longitudinal or experimental methods would be more appropriate for establishing causality, particularly in capturing the evolving nature of digital transformation and sustainability outcomes. The study's sample is restricted to managerial-level employees from commercial banks in Pakistan, potentially limiting the generalizability of results to other sectors, geographical contexts, or organizational hierarchies. Sector-specific dynamics and institutional environments vary significantly across countries and industries, which may mediate the strength or direction of the observed relationships. The reliance on self-reported data through structured questionnaires introduces risks of social desirability bias and common method variance, even though validated instruments were employed. Digital maturity levels, organizational culture, and absorptive capacity may significantly shape how FinTech tools are deployed and internalized. The insignificant moderation effects of transformational leadership and regulatory support could reflect measurement inadequacies or contextual misalignment, such as the lack of digital leadership capabilities or ineffective policy enforcement in the sampled context. The operationalization of transformational leadership may have overlooked digital-era competencies such as agility, technological visioning, or cross-functional orchestration.

It should be noted that future studies need to take into consideration multi-wave longitudinal designs to better understand the dynamic and iterative aspect of FinTech integration and digital transformation. To increase the external validity and contextual richness, the scope of investigation should be extended to

small and medium-sized enterprises (SMEs), non-financial institutions, cross-national samples. Also, the researchers are urged to consider other potential moderating or mediating variables which were not observed in a study. It is possible to mention the fact that the connection between FinTech adoption and digital transformation might be moderated by digital organizational culture and technological readiness (Heubeck and Meckl, 2022). Likewise, green dynamic capabilities or absorptive capacity can be the mediators in the transformation of digital change into sustainable performance results (Su et al., 2023). Future research could also attempt to provide the role of digital leadership agility as a more situation-specific construct than a traditional transformational leadership that is more aligned with the requirements of the technology challenges of adopting FinTech. The quality of institutions, such as enforcement capacity, policy coherence, and regulatory innovation (i.e., regulatory sandbox) may also be considered as subtle aspects of regulatory support. The incorporation of qualitative methods including interviews or case studies can reveal more information about the organizational behaviour, leadership processes and policy limitations not being fully expressed with the use of quantitative means. Multidimensional methods of this kind would offer a richer, context-sensitive idea of the sustainable transformation of the institutional environment through this FinTech adoption in different settings.

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