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Digital Financial Inclusion Among SMEs in Pakistan: The Role of Regulatory Support, Financing Barriers, and Market Opportunities, with Digital Financial Literacy and Trust as Moderators

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ABSTRACT

Digital financial inclusion has gained increasing attention in policy and academic discussions across developing economies. In Pakistan, small and medium enterprises (SMEs) play an important role in economic activity, yet many still struggle to gain meaningful access to, and make regular use of, digital financial services. This study examines how three conditions regulatory support, financing barriers, and market opportunities influence digital financial inclusion among SMEs, and whether digital financial literacy and trust alter the strength of these relationships. The framework draws on the Unified Theory of Acceptance and Use of Technology and Institutional Theory, comprising three direct relationships and six moderating relationships. Data were collected through a structured questionnaire completed by 620 managers and supervisors of SMEs in Karachi, Pakistan, and analyzed using partial least squares structural equation modelling in SmartPLS. Assessment of the measurement model confirmed acceptable reliability, convergent validity, and discriminant validity. The structural analysis showed that regulatory support and market opportunities are positively associated with digital financial inclusion, whereas financing barriers have a significant negative association. Digital financial literacy strengthens the effect of regulatory support and reduces the adverse effect of financing barriers, but does not moderate the market-opportunities relationship. Trust strengthens the effects of regulatory support and market opportunities, but does not moderate the financing-barriers relationship. Overall, the model explains a substantial proportion of the variation in digital financial inclusion.

Keywords: *Digital Financial Inclusion, SMEs, Digital Financial Literacy, Trust, Regulatory Support, Financing Barriers, Market Opportunities.*

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1. Introduction

Small and medium enterprises (SMEs) are widely regarded as the backbone of Pakistan's economy, constituting close to 90% of all business establishments, contributing roughly 30% of gross domestic product, absorbing about 78% of the non-agricultural labour force, and generating around a quarter of export earnings (SMEDA, 2024; State Bank of Pakistan, 2024). Given the scale of the sector, even small gains in productivity and resilience of the SMEs have a significant multiplier impact on national growth and employment (Nizam & Rashidi, 2024). Despite these efforts, the formal financial system continues to fail smaller and younger firms, as well as SMEs in developing economies, due to credit availability issues and the requirement for collateral, and because of information asymmetries (Zaimovic et al., 2025; Aliija et al., 2026). More effectively engaging SMEs in the financial system has thus gained increasing focus of both policy and scholarship (Azmeh, 2025).

The most promising way to fill this gap is through digital financial services. In the last decade Pakistan has made a swift transition from cash to digital finance, with access to digital financial services increasing from approximately 7% of adults in 2014 to approximately 35% in 2024, and mobile-money usage growing from under 1% to over 30% of adults in the same time period, while the State Bank of Pakistan's instant payment system Raast went from an initial launch in 2021 to over a billion low-cost, real-time transactions (Karandaaz, 2024; State Bank of Pakistan, 2024). Financial technology has the potential to lower transaction costs, mitigate information asymmetries, and enable alternative financing methods that are more accessible and cost-effective than traditional banking, thereby bringing a new dimension to financial inclusion: digital financial inclusion (DFI) the capacity of firms to access and actively avail of affordable financial services through digital channels that the traditional branch-based model may not efficiently reach segments (Amnas et al., 2024; Nagy et al., 2025).

However, the momentum for inclusion is not uniform, and, importantly, access has surpassed use. In Pakistan, one of the ironies is that the increase in the number of digital payments has outpaced significant, meaningful inclusion; a large number of account holders are inactive, most small businesses are not linked to formal credit and Pakistan ranks among the countries where over half of adults are not yet in accounts (Klapper et al., 2025; Nizam & Rashidi, 2024).For SMEs specifically, the decision to adopt and actively use digital financial services is shaped not by technology availability alone but by the surrounding institutional, financial, and market environment, and by the capabilities and dispositions of the managers who make those decisions (Setiawan et al., 2024; Hidayat-ur-Rehman et al., 2025). Identifying which of these forces genuinely move the needle on SME digital financial inclusion and under what conditions is the central concern of this study.

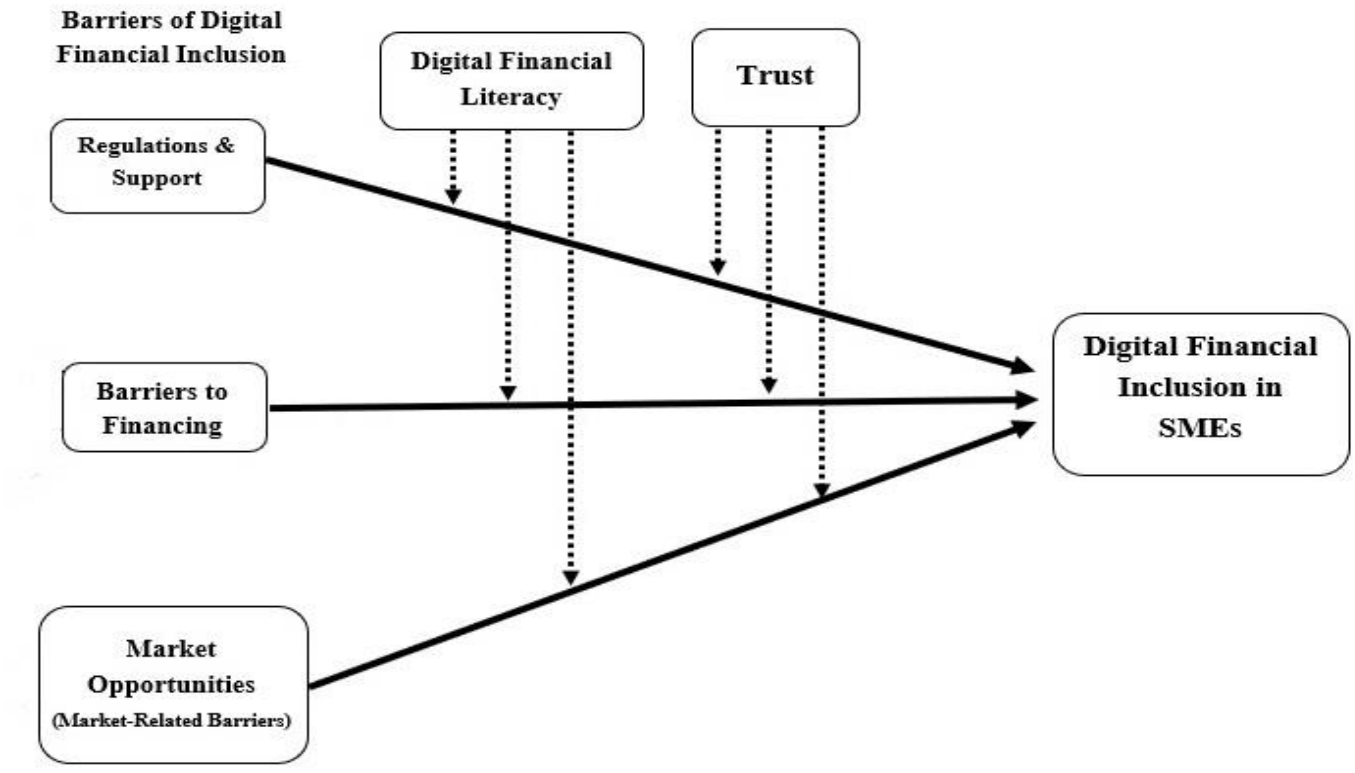
Three determinants are especially salient for SMEs in a developing-economy setting. The first is the regulatory and support environment the clarity, consistency, and supportiveness of the rules, institutions, and government programs that govern SME access to digital finance which is repeatedly found to condition financial-technology uptake and inclusion in emerging markets (Amnas et al., 2024; Mbarek, 2025). The second is the set of financing barriers that continue to characterize SME lending, including collateral requirements, the cost of credit, rigid credit-assessment procedures, and traditional banking practices poorly suited to small-firm needs, all of which are well documented as constraints on formal financial participation (Nizam & Rashidi, 2024; Aliija et al., 2026). The third is the market opportunity that digital finance opens up the extent to which digital tools expand a firm's reach to customers and new markets and enable it to adapt as conditions change (Setiawan et al., 2024; Shaikh & Amin, 2024). Together these capture the enabling and constraining conditions under which SMEs engage with digital financial services.

Whether these conditions translate into actual inclusion, however, is likely to depend on firm-level factors. Two are theoretically central. Digital financial literacy a manager's ability to understand, compare, secure, and appropriately select digital financial products probably conditions how effectively a firm converts a supportive regulatory environment or a market opportunity into genuine usage, and how well it navigates financing barriers; it is increasingly shown to shape fintech adoption and inclusion in developing economies (Zaimovic et al., 2025; Al-Shami et al., 2024).

Importantly trust is widely recognized as a factor for shaping the adoption of digital financial services. User's confidence in the reliability increases due to trust, security, integrity, and responsiveness of these services. Its role becomes especially important when users have limited digital financial knowledge or remain uncertain about digital payment systems, both of which have been linked with lower adoption levels (Aracil et al., 2025; Amnas et al., 2023). For this reason, digital financial literacy and trust are incorporated in the present study as moderating variables that may strengthen or weaken the influence of environmental conditions on digital financial inclusion (Amnas et al., 2024). Against this background, the study examines how regulations and support, financing barriers, and market opportunities affect digital financial inclusion among SMEs in Pakistan. It also evaluates whether digital financial literacy and trust change the strength of these relationships. The empirical analysis draws on primary survey responses obtained from managers and supervisors working in SMEs in Karachi, Pakistan's largest commercial center. Partial least squares structural equation modelling (PLS-SEM) is used to test the proposed framework, which includes three direct relationships and six moderating relationships (Hair et al., 2021).

The study has three contributions. First, it looks beyond access metrics that talk about inclusion to explore the environmental and firm-level factors that influence active digital financial inclusion for SMEs, as well as firm-specific data gathered for the purpose, rather than relying on secondary indicators that cannot detect competence in using financial tools (Zaimovic et al., 2025; Amnas et al., 2024). Second, digital financial literacy and trust are introduced as moderators, thus not only examining whether the regulatory, financing, and market environments have an impact but under which firm-level circumstances it is amplified or mitigateda question of direct relevance to policy and provider effort (Mbarek, 2025; Aracil et al., 2025). Third, it provides evidence from a specific context in Pakistan, a country that has a long history of the access–usage paradox and in which the inclusion of SMEs is a national priority; this evidence helps to guide the conversation on both scholarship and intervention design (Klapper et al., 2025; Nizam & Rashidi, 2024).

Conceptual Framework



2. Literature Review

2.1 Theoretical Framework

This study draws on two complementary theories: UTAUT to explain the adoption and use of digital financial services at the firm level and Institutional Theory to explain how the regulatory and support environment influences the use of digital financial services.

2.1.1 Unified Theory of Acceptance and Use of Technology

UTAUT proposes four main factors that shape technology use: performance expectancy, effort expectancy, social influence, and facilitating conditions, and that these effects are contingent on individual and contextual moderators (Venkatesh et al., 2003). The theory is appropriate here because digital financial inclusion is, at root, a technology-use outcome: it reflects whether an SME accesses and actively uses digital financial services. The regulatory-and-support environment and the market opportunities afforded by digital finance operate as facilitating conditions and performance-relevant expectations that encourage use, while financing barriers act as inhibiting conditions. The suitability of UTAUT for digital-finance adoption in developing economies is well established: extensions of the model explain fintech acceptance among Pakistani users (Shaikh & Amin, 2024), UTAUT integrated with a trust-theoretic model explains fintech adoption decisions (Amnas et al., 2023), and facilitating conditions and firm digital readiness are shown to drive fintech adoption among SMEs (Campanella et al., 2025). UTAUT also justifies the study's use of firm-level moderators' digital financial literacy and trust since the theory explicitly treats the environment–use relationship as contingent on user characteristics.

2.1.2 Institutional Theory

Institutional Theory holds that organizational behavior is shaped by the regulative, normative, and cultural-cognitive pillars of the environment the formal rules, regulations, and government action that constrain and enable firms (North, 1990; Scott, 2014). It is appropriate here because the regulatory-and-support construct captures precisely the regulative pillar: the clarity, consistency, and supportiveness of the rules and institutions governing SME access to digital finance. A predictable, supportive regulatory environment lowers the cost and risk of adopting digital finance and confers legitimacy on it. The relevance of the institutional lens to digital financial inclusion in emerging markets is well supported: institutional quality moderates the fintech–inclusion relationship across developing economies (Mbarek, 2025), government-led digitalization shapes fintech ecosystems and adoption (Senyo et al., 2024), and institutions condition the effect of digital financial inclusion on wider outcomes (Meniago, 2025). Together, UTAUT and Institutional Theory frame a model in which three environmental determinants influence digital financial inclusion, moderated by two firm-level factors.

2.2 Definition of Constructs

2.2.1 Digital Financial Inclusion

Digital financial inclusion refers to access to formal financial services through digital channels and their active use for activities such as payments, savings, credit, insurance, and account management and delivered at an affordable price to previously unincluded populations (Ozili, 2025; Amnas et al. 2024). A central issue in the modern-day conceptualization is that access does not imply use; and, e-money, mobile wallets, and digital payment services should only be considered when they are used to enhance financial wellness (Klapper et al., 2025; Ozili, 2025). For SMEs in emerging economies, DFI is linked to greater access to finance, higher efficiency, and higher DFI resilience and performance (Aliija et al., 2026; Azmeh, 2025). To accommodate the study's scope, DFI is the dependent construct in the model, the actual use of a technology-enabled service, and the environmental determinants and the firm's moderators act on it (Venkatesh et al., 2003). It is, therefore, crucial to understand the factors that make potential inclusion more active, especially in a country like Pakistan, where payment growth is outpacing greater inclusion (Nizam & Rashidi, 2024).

2.2.2 Regulations and Support

Regulations and support refer to the level of clarity, consistency, and supportiveness of the regulatory environment (formal rule, institutional framework and government programmes) in the adoption and use of digital financial services by SMEs (Abu et al., 2025). The regulatory environment is known to have a significant impact on the ability of SMEs to access financial services, both positively and

negatively (Abu et al., 2025; Amnas et al., 2024). Conceptually this construct aligns with the formal, institutional mechanisms and government actions that affect and shape firm behavior as described in Institutional Theory (North, 1990; Scott, 2014) and it also represents a facilitating condition in the UTAUT framework, reducing the cost and risk of adoption (Venkatesh et al., 2003).

2.2.3 Barriers to Financing

Barriers to financing are defined as the structural obstacles that impede SMEs' access to formal finance, including onerous collateral requirements, high interest and financing costs, rigid credit-assessment procedures, and traditional banking practices poorly suited to small-firm needs (Aliija et al., 2026; Nizam & Rashidi, 2024). Research consistently indicates that SMEs receive a smaller proportion of formal credit than their contribution to the economy would suggest, owing to information asymmetries, limited credit histories, and inadequate collateral (Azmeh, 2025; Aliija et al., 2026). Within the framework, financing barriers represent inhibiting conditions in UTAUT terms factors that raise the effort and perceived cost of engaging with formal and digital finance and, from an institutional standpoint, exclusionary practices within the financial system that impede active financial participation (Venkatesh et al., 2003; Nizam & Rashidi, 2024).

2.2.4 Market Opportunities

Market opportunities are defined as the extent to which digital financial services expand an SME's ability to reach customers and enter new markets, together with the firm's capacity to adapt its financial and business practices as market conditions and technologies change (Setiawan et al., 2024; Nagy et al., 2025). Digital financial inclusion is repeatedly shown to help SMEs overcome traditional constraints by broadening market access, lowering transaction costs, and enabling participation in wider digital marketplaces (Abu et al., 2025; Nagy et al., 2025). Theoretically, this construct operates through UTAUT's performance expectancy: the anticipated commercial benefits of digital finance, and the firm's adaptability in realising them, raise the expected value of use and thus encourage adoption (Venkatesh et al., 2003; Campanella et al., 2025).

2.2.5 Digital Financial Literacy

Digital financial literacy is defined as a manager's ability to understand the costs, benefits, and risks of digital financial products, to compare and select appropriate options, to safeguard financial data and transactions, and to judge the legitimacy of providers (Zaimovic et al., 2025). It extends conventional financial literacy to the digital domain and is increasingly identified as a prerequisite for effective engagement with digital finance in developing economies (Zaimovic et al., 2025; Al-Shami et al., 2024). Within the framework, digital financial literacy is a firm-level user characteristic that UTAUT treats as a contingency on the environment–use relationship, and it is therefore modelled as a moderator that conditions how strongly the environmental determinants translate into active use (Venkatesh et al., 2003; Amnas et al., 2024).

2.2.6 Trust

Trust is defined as an SME manager's confidence that digital financial service providers are reliable, keep financial information and transactions secure, act honestly, and respond effectively to problems (Aracil et al., 2025; Saadah & Setiawan, 2024). Because engagement with digital finance is inherently risk-laden and forward-looking, trust reduces perceived risk and uncertainty and is repeatedly identified as decisive for the adoption and continued use of financial technology, especially in emerging markets where confidence in providers is fragile (Aracil et al., 2025; Amnas et al., 2023). Within the framework, trust is the relational condition that complements the trust-extended UTAUT and is modelled as a moderator that strengthens or weakens the effect of the environmental determinants on digital financial inclusion (Amnas et al., 2023; Venkatesh et al., 2003).

2.3 Regulations and Support and Digital Financial Inclusion

The regulations-and-support construct encompasses the clarity and consistency of the rules governing digital finance, the strength of the institutional framework, and the usefulness of government programs for SMEs. Prior evidence consistently links a supportive regulatory environment to greater digital financial inclusion: perceived regulatory support strengthens the fintech–inclusion relationship (Amnas et al., 2024);

institutional quality conditions how far digital finance advances inclusion across emerging economies (Mbarek, 2025); and government-led digital initiatives and supportive ecosystems are identified as drivers of adoption and inclusion in developing contexts (Senyo et al., 2024; Setiawan et al., 2024).

Theoretically, this relationship draws on both anchoring theories. A regulatory framework characterized by clarity and support acts as a facilitating condition in UTAUT, which reduces the cost and complexity of digital financial service usage, thus increasing the likelihood of active service usage (Venkatesh et al., 2003). The regulative pillar in institutional terms (predictable formal rules and support from government) decreases the risk and uncertainty of adoption, and helps to legitimize digital finance, which in turn incentivizes firms to turn access into usage (North, 1990; Scott, 2014; Mbarek, 2025).

H1: *Regulations and support positively influence digital financial inclusion in SMEs.*

2.4 Barriers to Financing and Digital Financial Inclusion

The barriers to financing encompass structural challenges SMEs encounter in accessing formal finance, including the rigid credit-assessment process, traditional banking practices that are not conducive to SME financing, and high interest rates and financing costs, as well as onerous collateral requirements. The primary reason for the gap in credit access is that SMEs in developing economies are typically found to be more information-poor and credit-hungrier than larger firms, both because they lack credit histories, and because they possess less collateral, due to information asymmetries (Aliija et al., 2026; Azmeh, 2025). These obstacles are found to be more acute in areas where they increase the cost and complexity of accessing the formal financial system and contribute to the underutilization of financial services, while financing-side barriers are cited as one of the primary obstacles to digital financial inclusion in the Pakistani context (Nizam & Rashidi, 2024). This relationship is theorized to be associated with UTAUT's inhibiting conditions, that financing barriers raising effort and perceived cost of using formal and digital finance, which reduce behavioral use (Venkatesh et al., 2003). When seen from the institutional perspective, rigid and exclusionary financing practices in the financial system form regulatory and normative limitations on the movement of firms to participate in active digital financial activities (North, 1990; Nizam & Rashidi, 2024).

H2: *Barriers to financing negatively influence digital financial inclusion in SMEs.*

2.5 Market Opportunities and Digital Financial Inclusion

Market opportunities construct is the size of which digital financial services increase an SME's access to the market and their abilities to enter new markets, plus the firm's capacity to adapt its financial and business practices as conditions and technologies evolve. Digital financial services are found to expand market access and reduce transaction costs, as well as empowering firms to join broader digital markets; and flexible firms are more likely to translate these opportunities into active use of digital finance (Setiawan et al., 2024; Nagy et al., 2025). Aliija et al., 2026, repeatedly name the commercial pull of digital channels as a motivator for SMEs in emerging economies to adopt fintech. Theoretically, this relationship rests on UTAUT's performance expectancy: when digital finance is perceived to open commercial opportunities and the firm is able to adapt to exploit them, the expected benefits of use rise, encouraging adoption and active use (Venkatesh et al., 2003; Campanella et al., 2025).

H3: *Market opportunities positively influence digital financial inclusion in SMEs.*

2.6 The Moderating Role of Digital Financial Literacy

Digital financial literacy denotes a manager's ability to understand the costs, benefits, and risks of digital financial products, compare and select appropriate options, safeguard financial data and transactions, and judge the legitimacy of providers (Zaimovic et al., 2025). Beyond any direct effect, it is theorized to condition how effectively firms translate environmental conditions into active use a moderating role consistent with UTAUT's treatment of user characteristics as contingencies on the environment use relationship (Venkatesh et al., 2003; Amnas et al., 2024).

2.6.1 Digital Financial Literacy, Regulations and Support

Managers with higher digital financial literacy are better able to interpret regulatory requirements, comply with them, and make use of government support programs, so they can more fully exploit a supportive regulatory environment (Amnas et al., 2024; Al-Shami et al., 2024). Digital financial literacy is repeatedly shown to strengthen the pathway from enabling conditions to fintech adoption and inclusion in developing economies (Zaimovic et al., 2025; Al-Shami et al., 2024). Theoretically, in UTAUT terms, digital financial literacy raises the effectiveness of facilitating conditions: the same supportive regulatory environment yields greater use among more digitally literate managers, who can better convert that support into action (Venkatesh et al., 2003).

H4: *Digital financial literacy positively moderates the relationship between regulations and support and digital financial inclusion.*

2.6.2 Digital Financial Literacy, Barriers to Financing

Digitally literate managers can identify and access alternative digital financing channels and products, making them less dependent on the traditional lending practices that constitute financing barriers (Al-Shami et al., 2024; Aliija et al., 2026). Digital financial literacy is therefore expected to buffer the negative effect of financing barriers on inclusion, weakening that relationship. Theoretically, in UTAUT terms, digital financial literacy reduces the effort and perceived cost that inhibiting conditions impose, so financing barriers depress active use less among more literate managers (Venkatesh et al., 2003; Zaimovic et al., 2025).

H5: *Digital financial literacy weakens the negative relationship between barriers to financing and digital financial inclusion.*

2.6.3 Digital Financial Literacy, Market Opportunities

Digitally literate managers are better positioned to recognize the commercial opportunities that digital finance affords and to select the products that convert those opportunities into active use (Zaimovic et al., 2025; Setiawan et al., 2024). Digital financial literacy is thus expected to strengthen the market-opportunity relationship. Theoretically, in UTAUT terms, digital financial literacy amplifies performance expectancy: literate managers perceive and realize the benefits of digital finance more fully, so a given market opportunity translates into greater use (Venkatesh et al., 2003).

H6: *Digital financial literacy positively moderates the relationship between market opportunities and digital financial inclusion.*

2.7 The Moderating Role of Trust

Trust in digital financial service provider's confidence in their reliability, security, honesty, and responsiveness is central to engagement with digital finance because such engagement is risk-laden and depends on expectations about provider behaviour (Aracil et al., 2025; Saadah & Setiawan, 2024). Trust reduces perceived risk and is repeatedly found to drive the adoption and continued use of financial technology, particularly in emerging markets where confidence in providers is fragile (Saadah & Setiawan, 2024; Amnas et al., 2023). Consistent with the trust-extended UTAUT (Amnas et al., 2023), trust is modelled as a moderator of the environment–inclusion relationships.

2.7.1 Trust, Regulations and Support

When trust in providers is high, a supportive regulatory environment is more readily acted upon, because firms are more willing to commit to providers they believe are reliable and well-governed (Aracil et al., 2025; Amnas et al., 2024). Trust is thus expected to strengthen the regulations–inclusion relationship. Theoretically, trust complements the facilitating and legitimising role of the regulatory environment: regulatory support signals that digital finance is safe, and trust converts that signal into willingness to use (Venkatesh et al., 2003; Aracil et al., 2025).

H7: *Trust positively moderates the relationship between regulations and support and digital financial inclusion.*

2.7.2 Trust, Barriers to Financing

Firms that trust digital financial providers may be more willing to pursue digital financing alternatives despite conventional barriers, so trust is expected to buffer the negative effect of financing barriers on inclusion (Saadah & Setiawan, 2024; Aracil et al., 2025). Theoretically, trust lowers the perceived risk that makes financing obstacles discouraging, so barriers depress active use less among firms with higher trust in providers (Amnas et al., 2023).

H8: *Trust weakens the negative relationship between barriers to financing and digital financial inclusion.*

2.7.3 Trust, Market Opportunities

Firms are more likely to convert perceived digital-market opportunities into active use when they are confident that providers will perform reliably and securely (Aracil et al., 2025; Setiawan et al., 2024). Trust is therefore expected to strengthen the market-opportunity relationship. Theoretically, trust reinforces performance expectancy: the anticipated benefits of a market opportunity are more likely to be pursued when providers are trusted to deliver them safely (Venkatesh et al., 2003; Saadah & Setiawan, 2024).

H9: *Trust positively moderates the relationship between market opportunities and digital financial inclusion.*

3. Research Methodology

3.1 Research Design

This study uses a quantitative, cross-sectional, and explanatory design to evaluate how regulations and support, financing barriers, and market opportunities influence digital financial inclusion among SMEs. It also examines the moderating effects of digital financial literacy and trust on these relationships. A deductive approach guides the analysis, with hypotheses developed from the UTAUT and Institutional Theory, as discussed in Section 2, and subsequently examined using primary survey evidence. Since the required information was collected from respondents at one specific point in time, a cross-sectional design was considered suitable for analyzing the proposed relationships across a relatively large group of firms. Similar research designs have been applied in recent studies of digital finance and fintech adoption using structural equation modelling techniques (Amnas et al., 2024; Nagy et al., 2025; Saadah & Setiawan, 2024).

3.2 Data Source and Data Type

This research relies on primary quantitative data obtained through a structured questionnaire. Primary data were considered necessary because important constructs in the study, particularly digital financial literacy and trust, reflect respondents' perceptions and experiences and are generally unavailable in secondary firm-level databases (Zaimovic et al., 2025; Aracil et al., 2025).

The survey instrument consisted of two sections. The first gathered information about the respondents and the basic profile of their firms. The second focused on the six constructs included in the research model. Each construct was measured through several reflective items drawn and adapted from established scales, as explained in Section 3.4. Participants indicated their level of agreement with each statement on a five-point Likert scale, where 1 represented strongly disagree and 5 represented strongly agree. This type of scale has also been used in earlier studies examining fintech adoption and digital financial behavior (Amnas et al., 2024; Hidayat-ur-Rehman et al., 2025).

3.3 Population and Sample

The target population comprises small and medium enterprises operating in Karachi, Pakistan's largest commercial and industrial center. SMEs were selected as the empirical setting because of their considerable contribution to economic activity and growth in Pakistan. At the same time, many SMEs continue to experience limited access to formal financial services, which makes them an important group for research on digital financial inclusion (Nizam & Rashidi, 2024; Aliija et al., 2026).

The firm represents the unit of analysis in this study. Managers and supervisors were selected as key informants because their positions give them knowledge of the financial practices of their firms and their engagement with digital financial services. The use of managerial respondents as key informants is also consistent with established approaches in SME research (Nagy et al., 2025).

Respondents were chosen through stratified random sampling. To qualify for participation, respondents were required to meet three criteria. They had to hold a managerial or supervisory position, work within an SME, and be employed by a firm operating in Karachi. A total of 650 questionnaires were spread. Following data screening for incomplete responses and signs of inattentive participation, 620 valid and complete questionnaires were retained for the final analysis.

The retained sample provides an adequate basis for PLS-SEM analysis. With 620 valid responses, the study goes beyond the minimum sample requirements suggested by both the ten-times rule

and statistical power guidelines based on the greatest number of paths leading to an endogenous construct (Hair et al., 2019; Hair et al., 2021). A sample of this size also contributes to more stable model estimates and more precise bootstrap confidence intervals (Hair et al., 2019). Table 1 presents the demographic characteristics of the respondents and the profile of the participating firms.

Table 1

Demographic Variable	Category	Frequency	Percentage
Gender	Male	358	57.7%
	Female	252	40.6%
	Prefer not to disclose	10	1.6%
Age	18–25 years	112	18.1%
	26–35 years	204	32.9%
	36–45 years	168	27.1%
	46–55 years	92	14.8%
	Above 55 years	44	7.1%
Education	Secondary education or below	78	12.6%
	Diploma/technical qualification	126	20.3%
	Bachelor's degree	238	38.4%
	Master's degree	142	22.9%
	Doctorate/other professional qualification	36	5.8%
Respondent's role	Owner	214	34.5%
	Owner-manager	176	28.4%
	General/branch manager	142	22.9%
	Finance/accounting manager	88	14.2%
Firm size	Micro: fewer than 10 employees	298	48.1%
	Small: 10–49 employees	206	33.2%
	Medium: 50–249 employees	116	18.7%
Business sector	Retail and wholesale	138	22.3%
	Manufacturing	112	18.1%
	Professional and business services	98	15.8%
	Information technology and telecommunications	86	13.9%
	Hospitality and tourism	72	11.6%
	Transportation and logistics	64	10.3%
	Agriculture and other sectors	50	8.1%
Years in operation	Less than 3 years	126	20.3%

Demographic Variable	Category	Frequency	Percentage
	3–5 years	184	29.7%
	6–10 years	166	26.8%
	11–15 years	86	13.9%
	More than 15 years	58	9.4%

3.4 Variables and Measurement

The model comprises three independent variables (regulations and support, barriers to financing, market opportunities), one dependent variable (digital financial inclusion), and two moderating variables (digital financial literacy and trust). All constructs were modelled reflectively and measured with multi-item; five-point Likert scales adapted from established sources to enhance content validity (Hair et al., 2021). Regulations and support (3 items) and market opportunities (2 items) were adapted from the regulatory-support and market-access literature (Amnas et al., 2024; Abu et al., 2025; Setiawan et al., 2024); barriers to financing (4 items) from SME financing-constraint measures (Nizam & Rashidi, 2024; Aliija et al., 2026); digital financial literacy (4 items) from Zaimovic et al. (2025); trust (4 items) from Aracil et al. (2025) and related trust scales (Saadah & Setiawan, 2024); and digital financial inclusion (5 items) from Amnas et al. (2024) and Zaimovic et al. (2025). One regulations-and-support item was negatively worded and reverse-scored prior to analysis. The complete list of constructs, items, and sources is presented in Table 2.

Table 2

Construct	No. of Items	Citation
Regulations & Support	3	Amnas et al. (2024); OECD (2023) Setiawan et al. (2024); Amnas et al. (2024)
Barriers to Financing	4	World Bank Enterprise Surveys (2022); Nizam & Rashidi (2024)
Market Opportunities	2	OECD (2021); Setiawan et al. (2024)
Digital Financial Literacy	4	Zaimovic et al. (2025); OECD (2023)
Trust	4	Aracil et al. (2025); Saadah & Setiawan (2024)
Digital Financial Inclusion	5	Amnas et al. (2024); Zaimovic et al. (2025)

3.5 Model Specification

The conceptual model specifies three direct paths from regulations and support, barriers to financing, and market opportunities to digital financial inclusion and six interaction (moderating) effects, in which digital financial literacy and trust each moderate all three direct paths. The structural model is expressed as:

$$DFI = \beta_1 RS + \beta_2 BF + \beta_3 MO + \beta_4 DFL + \beta_5 TR + \beta_6(RS \times DFL) + \beta_7(BF \times DFL) + \beta_8(MO \times DFL) + \beta_9(RS \times TR) + \beta_{10}(BF \times TR) + \beta_{11}(MO \times TR) + \zeta$$

where DFI is digital financial inclusion; RS, BF, and MO are the independent variables; DFL and TR are the moderators; the interaction terms represent the moderating effects corresponding to H4–H9; and ζ is the structural error term. The moderating effects were estimated using the product-indicator approach, which is well established for testing interaction effects between latent variables in PLS-

SEM (Henseler & Chin, 2010; Hair et al., 2021).

3.6 Data Analysis Technique

The empirical data were examined through partial least squares structural equation modelling (PLS-SEM) using SmartPLS software (Ringle et al., 2022). PLS-SEM was selected because the proposed framework includes several latent variables and interaction effects. The approach is also suitable for prediction-focused studies, reflective measurement models, and datasets that do not meet strict assumptions of multivariate normality (Hair et al., 2019; Hair et al., 2021).

Following the procedure recommended by Hair et al. (2019), the analysis was carried out in two stages. The first stage focused on evaluating the measurement model. Indicator reliability was examined through outer loadings, while internal consistency was assessed using Cronbach's alpha and composite reliability. Convergent validity was evaluated through average variance extracted (AVE). Discriminant validity was examined using both the Fornell-Larcker criterion (Fornell & Larcker, 1981) and the heterotrait-monotrait ratio of correlations (HTMT), which provides a more sensitive assessment of discriminant validity (Henseler et al., 2015).

The second stage involved assessment of the structural model. Collinearity among the predictor constructs was examined through variance inflation factor (VIF) values. The proposed relationships were then evaluated by considering the magnitude and statistical significance of the path coefficients. The model's explanatory power was assessed through the coefficient of determination (R^2) (Hair et al., 2019).

Common-method bias was also examined through the full-collinearity VIF approach. The resulting values indicated no substantial common-method bias in the dataset (Kock, 2015; Podsakoff et al., 2003). Finally, the direct and moderating relationships were tested through a bootstrapping procedure based on 5,000 subsamples. Path estimates with t-values above 1.96 and p-values below 0.05 were treated as statistically significant at the 5 percent level (Hair et al., 2019).

4. Results

The data were analyzed in SmartPLS following the two-step procedure recommended for PLS-SEM: the measurement model was evaluated first, followed by the structural model (Hair et al., 2019).

4.1 Measurement Model Assessment

Construct reliability and convergent validity

Table 4.1: *Construct reliability and convergent validity*

Construct	Items	Cronbach's α	rho_A	AVE
Regulations & Support	3	0.781	0.793	0.696
Barriers to Financing	4	0.812	0.821	0.639
Market Opportunities	2	0.748	0.756	0.733
Digital Financial Literacy	4	0.836	0.842	0.670
Trust	4	0.851	0.858	0.693
Digital Financial Inclusion	5	0.869	0.875	0.657

The reflective measurement model demonstrates satisfactory reliability and convergent validity for all six constructs. Every indicator loads above the 0.708 benchmark, indicating acceptable indicator reliability (Hair et al., 2019). Internal-consistency reliability is confirmed on all three criteria: Cronbach's alpha (0.748–0.869) and rho_A (0.756–0.875) indicating reliable yet non-redundant indicators (Hair et al., 2021). Convergent validity is likewise established, as the average variance extracted (AVE) for each construct exceeds the 0.50 threshold (0.639–0.733), showing that each construct explains more than half of the variance of its indicators (Fornell & Larcker, 1981). The measurement instrument is therefore reliable and valid for structural analysis.

Indicator-level outer loadings

Table 4.2: *Indicator-level outer loadings*

Code	Indicator / dimension	Loading
RS1	Regulatory challenges	0.792
RS2	Institutional framework	0.850
RS3	Government support	0.860
BF1	Collateral requirements	0.721
BF2	Interest rates	0.783
BF3	Credit-assessment rigidity	0.846
BF4	Banking culture	0.838
MO1	Market accessibility	0.821
MO2	Adaptability	0.889
DFL1	Understanding digital financial products	0.747
DFL2	Comparing digital financial products	0.812
DFL3	Digital financial security and fraud protection	0.836
DFL4	Evaluating digital financial providers	0.881
TR1	Provider reliability	0.759
TR2	Security of financial information and transactions	0.821
TR3	Provider honesty	0.866
TR4	Resolution of transaction problems	0.894
DFI1	Access to formal accounts through digital channels	0.738
DFI2	Digital business payments and transfers	0.792
DFI3	Access to digital financial products	0.824
DFI4	Affordability and convenience	0.851
DFI5	Regular use of digital financial services	0.887

All 22 indicators exhibit outer loadings above 0.70, so no items required deletion on reliability grounds (Hair et al., 2019). The strongest indicators are adaptability (MO2 = 0.889), trust item TR4 (0.894), and the fifth inclusion item (DFI5 = 0.887), while the weakest retained indicator, the first collateral-requirements item (BF1 = 0.721), still comfortably exceeds the threshold. Each indicator meaningfully represents its assigned construct, supporting the retention of the full item set.

4.2 Discriminant Validity

Fornell–Larcker criterion

Construct	RS	BF	MO	DFL	TR	DFI
RS	**0.834**					
BF	0.382	**0.799**				
MO	0.516	0.294	**0.856**			
DFL	0.548	0.331	0.601	**0.819**		
TR	0.592	0.347	0.574	0.638	**0.832**	
DFI	0.611	0.489	0.653	0.672	0.691	**0.811**

Discriminant validity is supported under the Fornell–Larcker criterion: for every construct, the square root of the AVE (diagonal) is larger than its correlations with all other constructs (Fornell & Larcker, 1981). For example, the square root of AVE for digital financial inclusion (0.811) exceeds its highest correlation, that with trust (0.691). The negative correlations between barriers to financing and all other constructs are theoretically consistent, reflecting its role as an inhibiting condition. Each construct is therefore empirically distinct.

Heterotrait–monotrait ratio (HTMT)

Table 4.4: *Heterotrait–monotrait ratio (HTMT)*

Construct	RS	BF	MO	DFL	TR	DFI
RS	—					
BF	0.447	—				
MO	0.581	0.421	—			
DFL	0.616	0.438	0.684	—		
TR	0.672	0.456	0.651	0.731	—	
DFI	0.704	0.562	0.748	0.779	0.824	—

The HTMT criterion, considered more sensitive than the Fornell–Larcker test for detecting discriminant-validity problems, corroborates the result (Henseler et al., 2015). All HTMT values range from 0.421 to 0.824 and remain below the conservative 0.85 threshold, confirming that

respondents clearly distinguished among the six constructs (Henseler et al., 2015). The highest ratio, between trust and digital financial inclusion (0.824), is theoretically expected given the close conceptual link between provider trust and active use, yet still satisfies the criterion. Discriminant validity is thus firmly established.

4.3 Structural Model: Direct Effects

Before assessing the structural paths, lateral collinearity was examined; all inner-model VIF values were below the conservative threshold of 3.3, indicating that collinearity does not bias the estimates and that common-method bias is unlikely to be a concern (Kock, 2015). Path significance was assessed using bootstrapping with 5,000 subsamples (Hair et al., 2019).

Direct-effect path coefficients

Table 4.5: *Direct-effect path coefficients*

Hyp.	Relationship	β	t	p	Decision
H1	Regulations & Support → DFI	0.286	6.500	<0.001	Supported
H2	Barriers to Financing → DFI	−0.241	5.878	<0.001	Supported
H3	Market Opportunities → DFI	0.318	6.913	<0.001	Supported

All three direct hypotheses are upheld. Support and regulations are a positive driver of active use of digital financial services ($\beta = 0.286$, $p < 0.001$), consistent with literature that indicates that a supportive and clear regulatory framework also contributes to fintech-based digital financial inclusion in emerging markets (Amnas et al., 2024; Mbarek, 2025). Collateral requirements, high cost, and stringent credit practices negatively affect financing ($\beta = -0.241$, $p < 0.001$), consistent with other studies that have shown financing-side barriers hinder digital financial participation in Pakistan and in developing countries in general (Nizam & Rashidi, 2024; Aliija et al., 2026). The commercialization reaches and adaptability facilitated by digital finance are also strong factors in digital finance adoption and usage, with a direct effect ($\beta = 0.318$, $p < 0.001$) in this study on market opportunities (Setiawan et al., 2024; Nagy et al., 2025). The significance levels for all three paths confirm that these relationships are robust.

4.4 Structural Model: Moderating Effects

Moderating-effect path coefficients

Table 4.6: *Moderating-effect path coefficients*

Hyp.	Interaction	β	t	p	Decision
H4	Regulations & Support × DFL → DFI	0.137	3.341	0.001	Supported
H5	Barriers to Financing × DFL → DFI	0.112	2.800	0.005	Supported
H6	Market Opportunities × DFL → DFI	0.058	1.487	0.137	Rejected
H7	Regulations & Support × Trust → DFI	0.151	3.512	<0.001	Supported
H8	Barriers to Financing × Trust → DFI	0.041	1.079	0.281	Rejected
H9	Market Opportunities × Trust → DFI	0.126	3.000	0.003	Supported

Four of the six moderating hypotheses are supported. Digital financial literacy significantly strengthens the positive effect of regulations and support on inclusion (H4: $\beta = 0.137$, $p = 0.001$) and significantly buffers the negative effect of financing barriers (H5: $\beta = 0.112$, $p = 0.005$); because the barriers-to-financing base effect is negative, the positive interaction term indicates that the barrier becomes less damaging as digital financial literacy rises, weakening the negative relationship as hypothesized (Al-Shami et al., 2024; Zaimovic et al., 2025). However, digital financial literacy does not significantly moderate the market-opportunities path (H6: $\beta = 0.058$, $p = 0.137$), so H6 is rejected. Trust significantly strengthens both the regulations-and-support path (H7: $\beta = 0.151$, $p < 0.001$) and the market-opportunities path (H9: $\beta = 0.126$, $p = 0.003$), underscoring the role of provider trust in converting a supportive environment and market opportunities into active use (Aracil et al., 2025; Saadah & Setiawan, 2024). Trust does not significantly moderate the financing-barriers path (H8: $\beta = 0.041$, $p = 0.281$), so H8 is rejected. The two rejected interactions have p-values above 0.05, confirming their non-significance.

4.5 Explanatory Power

Table 4.7: *Explanatory Power*

Indicator	Result	Interpretation
R^2	0.641	Model explains 64.1% of variance in DFI
Adjusted R^2	0.636	Substantial explanatory power

The model demonstrates strong explanatory power. The R^2 of 0.641 indicates that the predictors and moderators jointly explain 64.1% of the variance in digital financial inclusion, which is regarded as substantial for behavioral research in this domain (Hair et al., 2019).

5. Discussion

The positive effect of regulations and support aligns with recent evidence that regulatory support and institutional quality advance fintech-based inclusion in emerging markets (Amnas et al., 2024; Mbarek, 2025), and with panel findings across developing economies that institutional quality

strengthens fintech-driven financial-inclusion outcomes (Azmeh & Al-Raeei, 2024). The State Bank's National Financial Inclusion Strategy 2024–28, the digital banks licensing framework, and the Raast instant-payment system have been seen to act as instruments of regulatory clarity and pull firms and providers into the digital financial system in the Pakistani context (Nizam & Rashidi, 2024). Theoretically, the result confirms both anchoring lenses: a clear regulatory context is a facilitating condition in UTAUT terms, and reduces the cost and difficulty of use (Venkatesh et al., 2003); regulative is a risk and uncertainty reducing context in institutional terms and legitimizes digital finance (North, 1990; Scott, 2014; Mbarek, 2025).

The very negative impact is corroborated by existing literature, which has shown that SMEs are more likely to be credit-rationed compared to larger enterprises, and that smaller and younger firms are more credit-rationed than their larger counterparts (Azmeh, 2025; Cornelli et al., 2023). This cross-country finding is confirmed by the fact that SMEs experience major or severe financing problems at approximately twice the frequency as do large enterprises in low-income economies (World Bank, 2024). These align with the ground realities in Pakistan, where access to formal credit and financing related constraints are among the key challenges for digital financial participation (DFP) among SMEs (Nizam & Rashidi, 2024).

Generally, financing barriers are believed to be UTAUT inhibiting conditions that increase the effort and perceived cost of using digital finance (Venkatesh et al., 2003), and institutional factors as barriers of exclusion in the financial system (North, 1990; Nizam & Rashidi, 2024). The commercial reach, low transaction costs, and adaptability offered by digital finance are the factors that seem to have the greatest direct impact, consistent with evidence that suggests that the commercial reach, low transaction costs, and adaptability offered by digital finance are the drivers of adoption among SMEs (Setiawan et al., 2024) and to stimulate financing and growth for SMEs in developing economies (Azmeh & Al-Raeei, 2024). The trend of retail going online and the growing availability of merchant-payment platforms and digital micro-lending in Pakistan have put the market case for digital finance more solidly into the hands of SMEs (Nizam & Rashidi, 2024). Theoretically these represent UTAUT's performance expectancy – if digital finance is perceived as increasing commercial opportunities, and the firm can change to take advantage of these opportunities, then the benefits of using digital finance increases and so will its active adoption (Venkatesh et al., 2003; Campanella et al., 2025).

The significant positive interaction indicates that digital financial literacy strengthens the regulations–inclusion relationship, consistent with evidence that literacy conditions and amplifies the pathway from enabling conditions to fintech adoption and inclusion (Zaimovic et al., 2025; Okello Candiya Bongomin et al., 2025). Recent cross-country work further shows that the behavioral benefits of digital finance are stronger among users with higher financial literacy, reflecting a threshold effect whereby FinTech amplifies existing capability rather than substituting for it (Başar et al., 2025). In Pakistan, where low digital and financial literacy is a documented brake on the usage of accounts that firms already hold, managers who can interpret rules and support programs are far better placed to translate a supportive environment into use (Nizam & Rashidi, 2024). Theoretically, digital financial literacy raises the effectiveness of UTAUT facilitating conditions (Venkatesh et al., 2003).

The positive interaction on a negative base effect shows that digital financial literacy buffers the damage of financing barriers, aligning with findings that digitally literate managers can locate and use alternative digital financing channels (Al-Shami et al., 2024; Aliija et al., 2026). Evidence on SME financing constraints indicates that digital credit can complement or partially substitute for traditional bank credit, but that realizing this depends on firms' capability to navigate digital alternatives (Cornelli et al., 2023). In Pakistan, the emergence of fintech micro-loans, invoice financing, and embedded lending means that managers with the skills to identify legitimate alternative products are less constrained by conventional collateral- and credit-assessment barriers (Nizam & Rashidi, 2024). Theoretically, digital financial literacy reduces the effort and perceived cost that UTAUT inhibiting conditions impose (Venkatesh et al., 2003; Zaimovic et al., 2025).

Contrary to expectation, digital financial literacy does not significantly moderate the market-opportunities path. One interpretation, consistent

with prior work, is that market opportunities already exert such a strong direct effect that their influence is relatively unconditional the commercial pull of digital finance operates similarly regardless of a manager's literacy (Setiawan et al., 2024). This aligns with the findings presented in an earlier study that suggests that FinTech moderators may be of limited incremental value when the base relationship is very strong (Ben Belgacem et al., 2024). The market case for digital finance reaching customers and accepting digital payments is becoming more self-evident and less complicated in Pakistan, compared to the regulatory and financing case, and therefore, digital financial exploitation might not involve the specialized literacy needed to navigate a regulatory and financing case (Nizam & Rashidi, 2024). Theoretically, this fits in with the contingency logic of UTAUT where PE is high and the enabling behavior is simple and observable, then user characteristics like literacy provide little moderating leverage (Venkatesh et al., 2003). Literacy seems to have a limited potential to moderate the more complex and knowledge-rich pathways.

The significant positive interaction between the variables, which is the strongest moderation in the model, confirms that trust conditions and strengthens the regulations–inclusion relationship, and that trust both conditions and mediates the relationship between the risk and adoption variables in developing countries (Aracil et al., 2025; Amnas et al., 2024). However, where perceived fraud and weak trust in providers are documented concerns, a positive regulatory environment is most effectively implemented by providers who are also perceived as reliable and secure (Nizam & Rashidi, 2024). Theoretically, the trust function is a complement to the legitimizing role of the regulatory pillar, where regulatory support signals to the public that digital finance is safe and the level of trust is translated into their willingness to use (Venkatesh et al., 2003; Aracil et al., 2025).

Financing barriers is not significantly moderated by trust. A likely explanation based on the literature is that financing barriers are structural and material, that is, collateral, interest rates, and credit rules, and thus can't be easily overcome by a relational approach like trust; trust can reduce perceived transactional risk, but cannot remove hard financial barriers (Azmeh, 2025; Cornelli et al., 2023). In such an environment of extreme credit rationing and its inherent systemic nature in Pakistan, a firm's trust in the providers has minimal impact on the decision whether it can pay collateral or meet price requirements (Nizam & Rashidi, 2024). Theoretically, this is a boundary condition on the trust extended UTAUT, as trust conditions the pathways that depend on willingness and perceived risk, but not one that is dominated by objective and structural cost barriers (Amnas et al., 2023; Venkatesh et al., 2003).

The significant positive interaction indicates that trust strengthens the market-opportunities relationship, consistent with evidence that firms convert perceived digital-market opportunities into active use most readily when confident that providers will perform reliably and securely (Aracil et al., 2025; Coffie & Hongjiang, 2025). Sustained-usage research shows that perceived trust and perceived value jointly drive continued FinTech use in developing economies (Setiawan et al., 2024; Saadah & Setiawan, 2024). In Pakistan, where adopting digital payment infrastructure still carries perceived risk for many SMEs, trust is what allows a commercial opportunity to be acted upon rather than merely recognized (Nizam & Rashidi, 2024). Theoretically, trust reinforces UTAUT's performance expectancy (Venkatesh et al., 2003; Saadah & Setiawan, 2024).

5.1 Theoretical Implications

This study contributes to the literature on digital financial inclusion in several ways. First, it extends the Unified Theory of Acceptance and Use of Technology (UTAUT) from the individual-user level, where it is most often applied, to the firm level of SME digital financial inclusion. The strong direct effects of regulations and support and of market opportunities confirm that UTAUT's facilitating conditions and performance expectancy operate as meaningful drivers of active use at the organizational level, while the negative effect of financing barriers demonstrates the explanatory value of treating structural constraints as inhibiting conditions within the same framework (Venkatesh et al., 2003; Amnas et al., 2024). The model's substantial explanatory power ($R^2 = 0.641$) indicates that an environment-plus-capability specification captures the phenomenon well.

Second, the study advances Institutional Theory by showing that the regulative pillar the clarity, consistency, and supportiveness of the rules

governing digital finance is empirically among the most important antecedents of SME digital financial inclusion in a developing economy (North, 1990; Scott, 2014; Mbarek, 2025). This reinforces the value of integrating institutional and technology-acceptance perspectives, rather than applying either alone, when explaining digital financial inclusion in weak-institution contexts.

Third, and most distinctively, the study refines the contingency logic of UTAUT by demonstrating that firm-level moderators do not condition all environmental pathways uniformly. Digital financial literacy strengthens the regulatory and financing-barrier pathways but not the market-opportunity pathway (H6 rejected), and trust strengthens the regulatory and market-opportunity pathways but not the financing-barrier pathway (H8 rejected). These two non-significant interactions are theoretically informative rather than anomalous: they suggest that capability-type moderators such as digital financial literacy matter most for complex, knowledge-intensive pathways and add little where the enabling behavior is simple and its performance benefit self-evident, whereas relational moderators such as trust matter where willingness and perceived risk are decisive but cannot offset objective, structural cost barriers (Zaimovic et al., 2025; Aracil et al., 2025). The study therefore contributes a more precise, pathway-specific account of when literacy and trust condition the environment–inclusion relationship, moving beyond the common assumption that such moderators operate globally.

Fourth, by conceptualizing and measuring digital financial inclusion as active usage rather than mere access, and by validating a reflective six-construct instrument, the study offers a usage-based operationalization that responds to calls to distinguish access from genuine inclusion (Ozili, 2025; Klapper et al., 2025). This provides a validated basis for future firm-level research in comparable emerging-market settings.

5.2 Practical Implications

The results provide specific policy recommendations, financial-service recommendations and guidelines for SME managers. The clear and stable regulatory environment as a lever for inclusion rather than a backdrop is signaled by the strong effect of regulations and support for policy makers and regulators. The material contribution of stronger enforcement of rules and transparent institutional structures, along with better-known and advertised support programs (e.g., the National Financial Inclusion Strategy, instant-payment systems) to increase SMEs' active uptake of digital financial services (DFS) (Amnas et al., 2024; Nizam & Rashidi, 2024). Consumer protection measures, fraud reduction and grievance-redress procedures should accompany regulatory reform, since trust magnifies the payoff to this regulatory effort (H7) and a supportive environment should be realized. Financial-service providers and fintech firms will see that eliminating financing barriers and cultivating trust rank as their top priorities.

Providers should consider creating digital credit that directly addresses structural barriers to inclusion, such as flexible approaches to collateral, alternative and data-driven credit assessment, and affordable credit for small businesses, which are hard barriers that cannot be overcome by relationship-building alone (H8); credit providers should not simply rely on the ability to build relationships to overcome hard barriers. Simultaneously, providers should focus on building more visible reliability, security, and responsive service to foster trust, which boosts usage, both from regulatory support and market opportunities (H7, H9), especially in a market where the perception of high fraud risk is proven to be a deterrent for usage (Aracil et al., 2025; Nizam & Rashidi, 2024).

Moderating effect of digital financial literacy leaves an unequivocal message for SME managers and business-support organizations: digital financial literacy is not just a personal asset, it is a strong capability that is crucial for the extent to which a supportive environment and the financing alternatives available to them are being utilized (H4, H5). Increase managers' knowledge and understanding of digital-financial-literacy through targeted training on digital-financial-literacy skills (product comparison, security practices and legitimate providers and alternative digital financing channels), which can help managers turn favorable conditions into active use and overcome traditional financing barriers (Zaimovic et al., 2025; Al-Shami et al., 2024). Notably, since literacy did not condition the market opportunity pathway (H6), literacy training should focus on the more complex regulatory and financing aspects instead of the

market case for digital finance, which is something that SMEs seem to understand and act upon, irrespective of being literate or not.

The outcomes showed that a single intervention was not enough. Furthermore, the study identifies three inter-connected and complementary elements of the mechanism for advancing SME digital financial inclusion in Pakistan: regulators maintain a clear and supportive framework, providers reduce the financing hurdles and gain trust, and capability building empowers managers to act.

5.3 Limitations

The results should be taken with some caveats. The first limitation is that it is a cross-sectional study where data is gathered at one specific point in time. This allows assessing hypothesized correlations but not providing causality or tracking the evolution of the correlations, as the direction of the influence between the environmental determinants and the financial inclusion of digitalization is assumed, rather than proven, based on theory.

Second, the data rely on a self-report format, and come from a single source within the firm managers. This may create common method and single informant bias. While the constructs are perceptual, the key informants are well positioned to report their perceptions of financial practices in their firm, the response does not necessarily reflect firm behavior as it is independently verified.

Third, the sample is confined to SMEs operating in Karachi. While Karachi is Pakistan's largest commercial center and an appropriate setting for this research, its firms may differ from SMEs in other cities, rural areas, or the large informal sector in their exposure to regulation, financing conditions, and digital infrastructure. The findings should therefore be generalized to the wider Pakistani SME population, and to other developing economies, with caution.

Fourth, the model focuses on three environmental determinants and two firm-level moderators. Although it explains a substantial share of the variance in digital financial inclusion ($R^2 = 0.641$), other relevant factors such as digital infrastructure quality, firm size and age, sector, managerial demographics, perceived security, and social influence were not included and may further shape inclusion.

Fifth, digital financial inclusion was measured as perceived active usage through a reflective scale. While this responds to the call to move beyond access-based measures, it does not incorporate objective transaction-level indicators of usage intensity, which could complement the perceptual measure.

Finally, the two non-significant moderating effects (H6 and H8), while theoretically interpretable, were not the subject of dedicated testing designed to probe their boundary conditions; the explanations offered are post hoc and warrant direct examination.

5.4 Future Research Directions

These limitations point to several avenues for future research. First, longitudinal or panel designs would allow researchers to examine how the environmental determinants and digital financial inclusion co-evolve and to move toward causal inference, for example by exploiting regulatory changes or the staggered rollout of digital-finance infrastructure as sources of identification.

Future research should address common-method bias through the use of multiple respondents within each firm. Researchers should also incorporate objective usage records, provider-side data, and transaction-level measures of digital financial activity alongside survey responses. This approach would strengthen measurement quality and provide a more reliable assessment of firms' actual engagement with digital financial services.

Future studies should extend data collection beyond Karachi. Including SMEs from other cities, rural areas, and the informal sector would provide a broader test of the model. Cross-country studies across developing economies would also help assess its generalizability and identify how differences in institutions, financial systems, and digital infrastructure shape the relationships examined in this study.

The model should be extended by introducing additional determinants and moderating factors. Relevant variables include digital infrastructure, firm size, firm age, industry sector, perceived security, social influence, and managerial characteristics. Future research should also examine possible mediating mechanisms. For example, researchers might test whether fintech adoption or firm-level digital readiness explains how environmental factors influence financial inclusion.

The two unsupported moderation effects deserve closer attention. Future studies should investigate why digital financial literacy does not alter the relationship between market opportunity and financial inclusion, and why trust does not weaken the effects of financing barriers. Researchers should examine whether these findings remain consistent across sectors, firm sizes, geographic settings, and institutional contexts. Other moderating variables, including perceived security and managerial experience, also deserve examination where financial literacy and trust show limited influence.

Qualitative and mixed-method research would add depth to the quantitative findings. Interviews, case studies, and field-based research would help explain how SME managers experience regulatory pressures, financing constraints, and trust in digital financial service providers. Such evidence would provide a clearer understanding of behavioral and contextual processes that survey measures often fail to capture.

Conflict of Interest

The authors showed no conflict of interest.

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