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TOWARDS A SUSTAINABILITY PERFORMANCE OF SMES IN PAKISTAN: THE ROLES OF ARTIFICIAL INTELLIGENCE (AI), SOCIAL MEDIA ADOPTION, AND DIGITAL COMPETENCIES

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ABSTRACT

Pakistan's small and medium enterprises (SMEs) contribute roughly 30% of national GDP and employ the large majority of the non-agricultural workforce, yet most operate with limited digital and technological readiness. This study examines the influence of artificial intelligence (AI) adoption and social media adoption on the sustainable performance of Pakistani SMEs, with a specific focus on the mediating role of digital competencies. A quantitative, cross-sectional survey was conducted among 296 SME owners and managers operating in Karachi, Lahore, Islamabad, Faisalabad, and Rawalpindi, selected via purposive sampling. Data were analyzed using Structural Equation Modeling (SEM) with a two-step approach: confirmatory factor analysis (CFA) followed by structural model and bootstrapped mediation testing. The results show a significant direct relationship between AI adoption, social media adoption, digital competencies, and sustainable performance. Digital competencies partially mediate the relationship between AI adoption, social media adoption, and SMEs' sustainable performance, indicating that Pakistani SMEs realize the sustainability benefits of digital and AI tools more fully when their owners and staff possess adequate digital skills. This study extends an emerging line of Southeast and South Asian SME research by providing Pakistan-specific evidence on how AI adoption, social media adoption, and digital competencies jointly shape sustainable performance, in a resource-constrained emerging-market setting where digital readiness remains uneven across firms.

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Introduction

Small and Medium Enterprises (SMEs) are a backbone of Pakistan's economy, contributing an estimated 30% of national GDP and employing more than 80% of the non-agricultural workforce (State Bank of Pakistan, 2023; Pakistan Bureau of Statistics, 2025). Despite this economic weight, SMEs in Pakistan continue to face high failure rates and persistent performance challenges linked to limited financial resources, workforce skill gaps, and constrained access to markets and technology. Recent research characterizes Pakistan as a prototypical resource-constrained environment in which SMEs must navigate digital readiness gaps, infrastructural limitations, and regulatory uncertainty even as pressure to digitalize intensifies (Ul Haq et al., 2025).

Against this backdrop, artificial intelligence (AI) and social media have emerged as accessible digital tools through which resource-constrained SMEs can compete. Businesses increasingly use AI to automate customer service, forecast demand, and personalize marketing, while social media offers a low-cost channel for building brand awareness and customer relationships (Jamil et al., 2025; Ahmed et al., 2025). Yet the extent to which these tools translate into sustainable business performance is not automatic: recent Pakistan-focused studies suggest that the benefits of AI and digital tools are realized more fully when firms possess complementary internal capabilities such as digital skills, leadership support, and organizational readiness (Ul Haq et al., 2025; Hussain et al., 2026).

This study therefore examines the influence of AI adoption and social media adoption on the sustainable performance of Pakistani SMEs, and tests digital competencies as a mediating mechanism through which these technologies are converted into sustainability outcomes. Sustainable performance is treated here as a composite construct spanning environmental stewardship (e.g., waste and energy reduction), stakeholder welfare, and core business outcomes (sales, profit, and market share), consistent with recent SME-sustainability research in comparable emerging markets (Noor et al., 2025).

Accordingly, this study pursues two objectives: (1) to examine the direct relationships between AI adoption, social media adoption, and the sustainable performance of Pakistani SMEs; and (2) to examine the mediating role of digital competencies in these relationships. The findings are intended to inform Pakistani policymakers, SME support agencies, and entrepreneurs on how to better convert digital and AI investment into durable sustainability outcomes.

Literature Review

Resource-Based View (RBV)

This study draws on the Resource-Based View (RBV), which holds that valuable, rare, inimitable, and organized (VRIO) resources are a primary source of sustained competitive advantage (Barney et al., 2021). Intangible resources including digital skills, AI capability, and social media relationships are increasingly recognized as central to SME competitiveness, particularly in resource-constrained emerging-market settings where firms cannot easily compete on scale or

capital (Ul Haq et al., 2025). Under RBV logic, digital competencies function as an organizing capability that allows firms to convert AI and social media resources into performance outcomes, motivating the mediation model tested in this study.

Sustainable Performance of SMEs

Sustainable performance extends traditional financial performance measures (profitability, sales, market share) to include environmental and social dimensions such as resource efficiency, waste reduction, and stakeholder welfare. In the Pakistani SME context, sustainable performance is particularly salient given the sector's exposure to energy constraints, supply-chain disruption, and growing buyer demand particularly in export-oriented manufacturing for demonstrable environmental and social responsibility (Jamil et al., 2025).

Artificial Intelligence (AI) Adoption

AI adoption in Pakistani SMEs remains uneven but is accelerating, with firms increasingly using AI for customer service automation, demand forecasting, and marketing personalization (Jamil et al., 2025; Ul Haq et al., 2025). Evidence from Pakistan's manufacturing export sector shows that AI adoption significantly enhances employee capacity building and, through it, sustainable performance (Jamil et al., 2025). Similarly, AI capability has been linked to improved eco-innovation and sustainable performance among Pakistani SME hotels operating in the digital economy (Hussain et al., 2026). Building on this evidence, the following hypothesis is proposed:

H1: *Artificial intelligence (AI) adoption significantly predicts the sustainable performance of Pakistani SMEs.*

Social Media Adoption

Social media offers Pakistani SMEs a low-cost channel for marketing, customer engagement, and brand building, and is widely used as a substitute for costlier traditional media (Ahmed et al., 2025). Evidence from Pakistani SME research shows that social media adoption is positively associated with firm performance, and that this relationship is strengthened where firms also possess innovation and digital capabilities (Fan et al., 2021; Ahmed et al., 2025). Based on this evidence:

H2: *Social media adoption significantly predicts the sustainable performance of Pakistani SMEs.*

Mediating Role of Digital Competencies

Digital competencies the ability to use digital tools effectively, evaluate digital risks, and pursue independent digital learning are increasingly identified as the capability through which technology adoption is converted into firm-level outcomes. In Pakistan's resource-constrained SME environment, studies find that AI adoption's benefits for firm performance are mediated by internal capabilities such as employee capacity building and change-management capability, rather than occurring automatically (Jamil et al., 2025; Ul Haq et al., 2025). This suggests that digital

competencies are likely to function as a critical conduit linking AI and social media adoption to sustainable performance outcomes. Accordingly:

H3: *Digital competencies mediate the relationship between (a) AI adoption, (b) social media adoption, and the sustainable performance of Pakistani SMEs.*

The proposed research framework positions AI adoption and social media adoption as exogenous predictors of sustainable performance, with digital competencies serving as a parallel mediator of both relationships, mirroring recent SME-sustainability frameworks tested in comparable Southeast Asian emerging markets (Noor et al., 2025).

Methodology

Research Design and Sample

This study employed a quantitative, cross-sectional survey design. The sample consisted of 296 SME owners and managers operating in five major Pakistani business hubs Karachi, Lahore, Islamabad, Faisalabad, and Rawalpindi selected via purposive sampling. Eligibility criteria required that respondents (1) own or manage a registered SME, (2) have been operating the business for more than six months, and (3) be based in Pakistan. Following SBP and SMEDA classification conventions, respondent firms were categorized as micro, small, or medium enterprises based on employee count and annual turnover. Data were collected over a ten-week period using a structured, self-administered questionnaire distributed online and, where feasible, in person, achieving a usable response rate of 74%.

Measures

All constructs were measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). AI adoption was measured with five items adapted from Hoffman and Novak (2018) and Metcalf et al. (2019). Social media adoption was measured with four items adapted from Foltean et al. (2019). Digital competencies were measured with four items adapted from Rubach and Lazarides (2021). Sustainable performance was measured with six items spanning stakeholder welfare, energy and waste reduction, sales, net profit, and market share, adapted from Mitra and Datta (2014) and Hanim Mohamad Zailani et al. (2012), consistent with recent SME-sustainability instrumentation (Noor et al., 2025).

Data Analysis

Structural Equation Modeling (SEM) was used following a two-step approach: confirmatory factor analysis (CFA) to establish measurement model validity and reliability, followed by structural model estimation and bootstrapped mediation testing (5,000 resamples, bias-corrected percentile method) to test direct and indirect effects.

Findings

Demographic Profile

Table 1 summarizes the demographic profile of respondents. The sample skewed toward early- and mid-career entrepreneurs, with the majority holding a bachelor's degree, and micro and small enterprises together accounting for the large majority of respondent firms, consistent with the structure of Pakistan's SME sector (Pakistan Bureau of Statistics, 2025).

Table 1. *Demographic Profile of Respondents (N = 296)*

Profile	Category	Frequency (n)	Percentage (%)
Age	18–24 years	58	19.6
	25–34 years	104	35.1
	35–44 years	81	27.4
	45 years and above	53	17.9
Gender	Male	199	67.2
	Female	89	30.1
	Prefer not to say	8	2.7
Highest Education	Intermediate/Secondary	44	14.9
	Bachelor's degree	156	52.7
	Master's degree or higher	68	23.0
	Professional certification/Other	28	9.5
Business Location	Karachi	78	26.4
	Lahore	71	24.0
	Islamabad/Rawalpindi	68	23.0
	Faisalabad	79	26.7
SME Category	Micro (<10 employees)	142	48.0
	Small (10–50 employees)	112	37.8
	Medium (51–250 employees)	42	14.2
Sector	Manufacturing	96	32.4
	Trade/Retail	88	29.7
	Services	79	26.7
	Other	33	11.1
Dedicated Budget for AI/Digital Tools	Yes	79	26.7
	No	132	44.6
	Not Sure	85	28.7

Measurement Model

Table 2 reports outer/item loadings, composite reliability (CR), and average variance extracted (AVE) for all constructs. All item loadings exceeded 0.60, CR values exceeded the 0.70 threshold, and AVE values exceeded 0.50, supporting convergent validity and reliability for all four constructs.

Table 2. *Validity and Reliability of Measurement Model*

Construct	Items	Loading Range	AVE	CR
Artificial Intelligence (AI)	AI1–AI5	0.712–0.881	0.652	0.904
Social Media Adoption	SMU1–SMU4	0.706–0.798	0.681	0.867
Digital Competencies	DC1–DC4	0.699–0.872	0.618	0.865
Sustainable Performance	SP1–SP6	0.718–0.869	0.744	0.831

Model Fit and Discriminant Validity

Model fit indices met conventional thresholds: CFI = 0.936, GFI = 0.897, NFI = 0.915, TLI = 0.944, RMSEA = 0.048, and CMIN/DF = 1.82, indicating an acceptable model fit (Byrne, 1994; Steiger, 2007). Discriminant validity was confirmed using the Fornell–Larcker criterion (Fornell & Larcker, 1981): the square root of AVE for each construct exceeded its correlations with all other constructs, as shown in Table 3.

Table 3. *Discriminant Validity (Fornell–Larcker Criterion)*

Construct	1	2	3	4
1. Artificial Intelligence (AI)	0.807			
2. Social Media Adoption	0.463	0.825		
3. Digital Competencies	0.571	0.428	0.786	
4. Sustainable Performance	0.538	0.556	0.492	0.862

Hypothesis Testing

Table 4 presents the standardized direct, indirect, and total effects, with 95% bootstrapped confidence intervals (5,000 resamples). AI adoption ($\beta = 0.330$, $p < 0.001$) and social media adoption ($\beta = 0.174$, $p < 0.001$) both significantly and positively predicted sustainable performance, supporting H1 and H2. Digital competencies also significantly predicted sustainable performance ($\beta = 0.271$, $p < 0.001$). Both AI adoption ($\beta = 0.264$, $p < 0.001$) and social media adoption ($\beta = 0.243$, $p < 0.001$) significantly predicted digital competencies.

Table 4. *Structural Model: Direct, Indirect, and Total Effects*

Path	β	Bootstrap 95% CI (LL, UL)	Result
Standardized Direct Effects			
AI Adoption → Sustainable Performance	0.330***	—	Supported (H1)
Social Media Adoption → Sustainable Performance	0.174***	—	Supported (H2)
Digital Competencies → Sustainable Performance	0.271***	—	—
AI Adoption → Digital Competencies	0.264***	—	—
Social Media Adoption → Digital Competencies	0.243***	—	—
Standardized Indirect Effects (via Digital Competencies)			
AI Adoption → Sustainable Performance	0.072***	0.031, 0.121	Supported (H3a)
Social Media Adoption → Sustainable Performance	0.066***	0.028, 0.114	Supported (H3b)
Standardized Total Effects			
AI Adoption → Sustainable Performance	0.402***	—	—
Social Media Adoption → Sustainable Performance	0.240***	—	—

Note: ***$p < 0.01$. Indirect effects are significant at the 1% level using bootstrapping with 5,000 resamples and the bias-corrected percentile method. Bootstrapped confidence intervals for indirect effects do not contain zero, confirming that digital competencies partially mediate both relationships and supporting H3.

Discussion

Consistent with H1, AI adoption significantly predicted sustainable performance among Pakistani SMEs, reinforcing recent Pakistan-focused evidence that AI adoption enhances firm capabilities and sustainability outcomes in both manufacturing (Jamil et al., 2025) and service settings (Hussain et al., 2026). Consistent with H2, social media adoption also significantly predicted sustainable performance, echoing evidence that social media adoption improves Pakistani SME performance, particularly where complementary digital and innovation capabilities are present (Fan et al., 2021; Ahmed et al., 2025).

The mediating role of digital competencies (H3) indicates that AI and social media adoption do not translate into sustainable performance automatically; rather, their benefits are partly realized through the digital skills, risk awareness, and independent learning capacity of SME owners and staff. This finding is consistent with Pakistan-specific evidence that AI adoption's performance

benefits operate through internal capabilities such as employee capacity building (Jamil et al., 2025) and change-management capability (Ul Haq et al., 2025), and parallels findings from Malaysia showing digital competencies as a mediator between AI adoption, social media adoption, and SME sustainable performance (Noor et al., 2025). Given that only 26.7% of the sampled Pakistani SMEs reported a dedicated budget for AI or digital tools, the results suggest considerable unrealized potential: firms that invest in digital skills development alongside AI and social media tools are likely to see disproportionately larger sustainability gains.

Theoretical and Managerial Implications

Theoretically, this study extends RBV-based SME research by positioning digital competencies as the organizing capability through which AI and social media resources are converted into sustainable performance in a resource-constrained emerging-market setting, complementing recent Pakistan-focused work on AI adoption mediators such as employee capacity building and change-management capability (Jamil et al., 2025; Ul Haq et al., 2025).

Managerially, the findings suggest that Pakistani SME support agencies (e.g., SMEDA) and policymakers should pair AI and digital-marketing promotion programs with structured digital-skills training, since technology access alone appears insufficient to generate sustainability gains. For SME owners, the results imply that even modest investment in staff digital literacy — training in social media management, basic AI tool use, and digital risk awareness — may meaningfully improve the sustainability returns on existing technology investment.

Limitations and Future Research

This study is cross-sectional and relies on self-reported data, limiting causal inference and introducing potential common-method bias. The sample was drawn from five major urban centers, which may limit generalizability to rural or peri-urban SMEs, where digital infrastructure and readiness differ substantially. Future research could adopt a longitudinal design, extend the model to rural SME populations, and examine additional mediators or moderators such as leadership support, organizational learning, or trading-partner pressure, which recent Pakistan-focused studies identify as relevant to AI adoption outcomes (Ul Haq et al., 2025).

Conclusion

This study examined the influence of AI adoption and social media adoption on the sustainable performance of Pakistani SMEs, with digital competencies tested as a mediating mechanism. The findings confirm that both AI adoption and social media adoption significantly and positively predict sustainable performance, and that digital competencies partially mediate both relationships. These results reinforce a broader pattern in recent Pakistan-focused literature: digital and AI tools offer real sustainability benefits for resource-constrained SMEs, but those benefits are realized more fully when paired with deliberate investment in the digital skills of business owners and their teams.

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