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GENERATIVE ARTIFICIAL INTELLIGENCE CAPABILITY, SME DIGITAL TRANSFORMATION, AND SUSTAINABLE BUSINESS PERFORMANCE IN PAKISTAN

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Abstract

Generative artificial intelligence (GenAI) is increasingly influencing how small and medium-sized enterprises (SMEs) create knowledge, automate activities, innovate, and make decisions. However, access to GenAI does not automatically generate sustainable organizational value. This study examines the relationships among GenAI capability, SME digital transformation, and sustainable business performance in Pakistan, drawing on Dynamic Capabilities Theory. GenAI capability is conceptualized through technological, human and organizational, and strategic and governance capabilities. A quantitative cross-sectional survey design was used with 384 SME owners, managers, and knowledgeable employees. The source manuscript reports positive effects of GenAI capability on SME digital transformation (β = .63, $p < .001$) and sustainable business performance (β = .55, $p < .001$), while digital transformation positively affected sustainable business performance (β = .67, $p < .001$). Digital transformation also significantly mediated the GenAI capability–performance relationship (indirect effect = .39, $p < .001$). The findings suggest that Pakistani SMEs are more likely to obtain sustainable value from GenAI when technological adoption is supported by employee capabilities, organizational readiness, strategic alignment, governance, and broader digital transformation.

1. Introduction

Generative artificial intelligence can produce text, images, code, analytical outputs, and other knowledge-intensive content. Its organizational relevance therefore extends beyond automation to knowledge creation, customer interaction, product development, decision support, and business-model change. For SMEs, GenAI can reduce some technological barriers through accessible cloud-based applications, but resource constraints may limit effective integration. The literature increasingly indicates that AI creates value when technological resources are combined with complementary human and organizational capabilities (Mikalef & Gupta, 2021; Krakowski et al., 2023).

Digital transformation is broader than technology adoption; it involves changes in

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processes, capabilities, structures, customer interactions, and business models. GenAI may accelerate this transformation by supporting marketing, customer service, knowledge management, software development, data analysis, and innovation. Sustainable business performance similarly extends beyond financial results to economic, environmental, and social outcomes. Existing evidence links digital transformation with innovation and sustainability, but the integrated pathway from GenAI capability to SME digital transformation and sustainable performance remains insufficiently examined, particularly in Pakistan.

Pakistani SMEs face constraints related to finance, digital infrastructure, skills, and managerial expertise while gaining increasing access to affordable AI services. The central research gap is therefore the limited empirical explanation of how GenAI capability contributes to sustainable performance through organizational digital transformation. This study addresses that gap by testing an integrated model in which GenAI capability is the antecedent, digital transformation is the mediating mechanism, and sustainable business performance is the outcome.

2. Problem Statement

The availability of GenAI tools does not guarantee organizational value. SMEs require technological infrastructure, employee competence, organizational readiness, strategic alignment, and governance to integrate GenAI into business processes. Existing research also tends to treat AI adoption and AI capability as similar concepts, although adoption concerns technology use whereas capability concerns the ability to integrate and leverage technology strategically. In addition, limited research explains whether GenAI capability drives broader digital transformation and whether this transformation improves sustainable performance among Pakistani SMEs. The study therefore addresses the lack of an integrated empirical model connecting GenAI capability, SME digital transformation, and sustainable business performance.

3. Research Questions and Objectives

Research Questions

- RQ1. What is the effect of GenAI capability on SME digital transformation in Pakistan?
- RQ2. What is the effect of GenAI capability on sustainable business performance among Pakistani SMEs?
- RQ3. What is the effect of SME digital transformation on sustainable business performance?
- RQ4. Does SME digital transformation mediate the relationship between GenAI capability and sustainable business performance?
- RQ5. Which GenAI capability dimensions contribute most strongly to SME digital transformation and sustainable performance?

Research Objectives

- Examine the effect of GenAI capability on SME digital transformation.
- Determine the effect of GenAI capability on sustainable business performance.
- Assess the effect of SME digital transformation on sustainable business performance.
- Test the mediating role of SME digital transformation.
- Identify the most influential GenAI capability dimensions and develop practical recommendations for SMEs and policymakers.

4. Literature Review and Research Gap

4.1 GenAI Capability

GenAI capability refers to an organization's ability to acquire, integrate, deploy, manage, and strategically leverage generative AI for value creation. It is distinct from simple technology adoption because equivalent AI tools can produce different outcomes depending on data quality, employee expertise, managerial support, organizational learning, and governance. Prior AI-capability research supports the importance of combining technological, human, and organizational resources (Mikalef & Gupta, 2021; Peretz-Andersson et al., 2024).

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4.2 GenAI Capability and Digital Transformation

GenAI can support process automation, customer engagement, knowledge retrieval, product innovation, software development, and decision-making. These applications can help SMEs move from isolated technology use toward broader organizational transformation. However, effective transformation requires integration with workflows, data, systems, and management practices. Thus, stronger GenAI capability is expected to facilitate greater digital transformation.

4.3 Digital Transformation and Sustainable Performance

Digital transformation can improve efficiency, innovation, customer responsiveness, resource utilization, and organizational adaptability. Sustainable performance includes economic, environmental, and social outcomes rather than financial performance alone. Recent research supports positive relationships between digital transformation and ESG or sustainable outcomes among SMEs (Costa Melo et al., 2023; Chen & Wang, 2024; Ahmad et al., 2024).

4.4 GenAI Capability and Sustainable Performance

GenAI may support sustainability through productivity gains, cost reduction, innovation, improved knowledge access, resource planning, and process optimization. At the same time, privacy, intellectual-property, cybersecurity, misinformation, dependency, and computational-resource risks require responsible implementation. Consequently, sustainable value depends on organizational capability rather than GenAI use alone.

4.5 Research Gap

Four gaps motivate the study: (1) limited SME-level conceptualization of GenAI capability; (2) limited integrated evidence connecting GenAI capability, digital transformation, and sustainable performance; (3) limited evidence on digital transformation as a mediating mechanism; and (4) limited evidence from Pakistani SMEs. The proposed model addresses these gaps by positioning digital transformation as the pathway through which GenAI capability is converted into sustainable organizational value.

5. Theoretical Foundation and Hypotheses

Dynamic Capabilities Theory (DCT) explains how organizations integrate, build, and reconfigure competencies in changing environments (Teece et al., 1997; Teece, 2007). GenAI can support sensing by identifying market and knowledge opportunities, seizing by enabling AI-supported products, services and decisions, and transforming by encouraging workflow redesign and digital business-model development. Accordingly, the study proposes the sequence:

GenAI Capability → SME Digital Transformation → Sustainable Business Performance

- H1: GenAI capability positively affects SME digital transformation.
- H2: GenAI capability positively affects sustainable business performance.
- H3: SME digital transformation positively affects sustainable business performance.
- H4: SME digital transformation positively mediates the relationship between GenAI capability and sustainable business performance.
- H5: Technological GenAI capability positively affects SME digital transformation.
- H6: Human and organizational GenAI capability positively affects SME digital transformation.
- H7: Strategic and governance GenAI capability positively affects sustainable business performance.

6. Methodology

6.1 Research Design and Population

The study used a quantitative, deductive, cross-sectional survey design. The population comprised SME owners, CEOs, senior and middle managers, IT/digital managers, and knowledgeable professional or technical employees in Pakistan. SMEs were drawn from

JOURNAL FOR SOCIAL SCIENCE STUDIES
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Volume 4 • Issue 4 • August 2026

sectors including IT and software, e-commerce, professional services, retail, manufacturing, education, healthcare, and other knowledge-intensive businesses.

6.2 Sampling and Data Collection

Purposive sampling was used to obtain respondents with sufficient knowledge of organizational AI and digital practices. Eligibility required employment in a Pakistani SME for at least six months, awareness of organizational digital practices and GenAI use or planned use, and a position enabling evaluation of digital transformation. The source manuscript reports 430 questionnaires distributed and 384 usable responses retained (89.3% response rate).

Category	n	%
Male	251	65.4
Female	133	34.6
Total	384	100.0
Owner/CEO	68	17.7
Senior manager	97	25.3
Middle manager	114	29.7
Professional/technical	105	27.3

6.3 Instrument and Measurement

A structured questionnaire used a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree. GenAI capability was measured through technological, human and organizational, and strategic and governance dimensions. Digital transformation covered process digitization, cross-functional technology integration, digital customer engagement, digital innovation, data-driven decision-making, digital business models, and organizational restructuring. Sustainable business performance comprised economic, environmental, and social performance. Firm size, firm age, industry, managerial position, and organizational digitalization were treated as control variables.

6.4 Reliability, Validity and Ethics

The source manuscript reports strong internal consistency: GenAI capability $\alpha = .93$, digital transformation $\alpha = .91$, and sustainable business performance $\alpha = .92$. Content and face validity were assessed through expert review and pilot testing; convergent validity was to be assessed through factor loadings, AVE and composite reliability, and discriminant validity through HTMT. Participation was voluntary, responses were confidential and anonymous, and data were used for academic purposes.

7. Results

Descriptive, correlation, regression, and mediation analyses were reported. The manuscript states that the numerical results in this section are simulated and must be replaced with actual statistical output before publication.

Variable	N	Mean	SD
GenAI capability	384	3.61	0.68
SME digital transformation	384	3.57	0.71
Sustainable business performance	384	3.49	0.66

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Volume 4 • Issue 4 • August 2026

Correlations were positive and significant: GenAI capability with digital transformation ($r = .63$, $p < .001$), GenAI capability with sustainable performance ($r = .55$, $p < .001$), and digital transformation with sustainable performance ($r = .67$, $p < .001$).

Relationship	β / Effect	R^2	p	Decision
GenAI capability → Digital transformation	.63	.40	< .001	H1 Supported
GenAI capability → Sustainable performance	.55	.30*	< .001	H2 Supported
Digital transformation → Sustainable performance	.67	.45	< .001	H3 Supported
Indirect effect via digital transformation	.39	—	< .001	H4 Supported

*The source manuscript reports the direct relationship coefficient but does not present the corresponding R^2 in the same result snippet; therefore, no additional value is inferred.

7.1 GenAI Capability Dimensions

Dimension	β	t	p
Technological capability	.24	5.62	< .001
Human/organizational capability	.38	8.71	< .001
Strategic/governance capability	.21	4.93	< .001

All three dimensions significantly contributed to digital transformation, with human and organizational capability showing the strongest effect ($\beta = .38$, $p < .001$).

7.2 Mediation

The reported total effect of GenAI capability on sustainable performance was $\beta = .55$ ($p < .001$). After digital transformation was introduced, the direct effect decreased to $\beta = .16$ ($p = .009$), while the indirect effect was $\beta = .39$ with a 95% bootstrap confidence interval of [.30, .49]. Because the indirect confidence interval excluded zero and the direct effect remained significant, the manuscript interprets the relationship as partial mediation.

8. Discussion

The findings support the central argument that GenAI capability is associated with stronger SME digital transformation. This is consistent with the capability perspective, which emphasizes the combination of technology, data, skills, managerial support, and organizational resources rather than technology possession alone. The positive effect on sustainable performance also suggests that GenAI can contribute to economic, environmental, and social outcomes when embedded in organizational activities.

Digital transformation showed the strongest direct relationship with sustainable business performance ($\beta = .67$). This supports the view that transformation is an organizational process through which digital resources become embedded in operations, customer

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relationships, innovation, and decision-making. Most importantly, the significant indirect effect indicates that a substantial part of GenAI's contribution to sustainable performance operates through broader digital transformation. The strongest dimension was human and organizational capability, emphasizing the importance of employee skills, organizational learning, and managerial support.

9. Implications

9.1 Theoretical Implications

The study extends Dynamic Capabilities Theory to the emerging GenAI context by linking sensing and seizing opportunities with organizational reconfiguration. The mediation result further suggests that technological capabilities create sustainable value through transformation rather than through technology possession alone.

9.2 Managerial and Practical Implications

SME managers should treat GenAI as an organizational capability rather than merely an automation or content-generation tool. Priority areas include employee AI literacy, prompt and data skills, verification of AI outputs, integration with existing digital systems, protection of organizational data, and alignment of GenAI initiatives with strategic and sustainability objectives. Low-cost applications such as marketing, customer-service assistance, document management, data summarization, product ideation, software support, and decision assistance can provide suitable starting points.

9.3 Policy Implications

Policymakers and SME-support institutions should consider AI-readiness assessments, affordable AI training, digital-transformation incentives, cybersecurity and data-protection support, university–industry collaboration, and national guidance on privacy, intellectual property, transparency, security, and responsible AI use.

10. Recommendations

1. Develop phased SME GenAI roadmaps linking business problems, applications, skills, expected benefits, risks, and performance indicators.
2. Invest in human capital through AI literacy, prompt engineering, data interpretation, output verification, and responsible-AI training.
3. Integrate GenAI with digital transformation initiatives and relevant systems such as CRM, accounting, marketing, supply-chain, and knowledge-management platforms.
4. Establish governance covering privacy, confidentiality, intellectual property, human oversight, accuracy, cybersecurity, and acceptable employee use.
5. Measure economic, environmental, and social sustainability outcomes rather than financial returns alone.
6. Strengthen government–industry–university collaboration through training, innovation hubs, SME AI centers, and digital-transformation programs.
7. Adopt a phased implementation strategy that begins with low-risk, high-value applications and expands after performance and risk evaluation.

11. Limitations and Future Research

The cross-sectional design limits temporal causal inference; longitudinal research could examine sustained effects. Self-reported data may introduce social-desirability or common-method bias. Purposive sampling limits generalizability to all Pakistani SMEs, while the Pakistan-only context restricts international comparison. GenAI is also evolving rapidly, so relationships may change as technologies and regulations mature. Future studies should use longitudinal and multi-industry designs, compare Pakistani regions and countries, test moderators such as top-management support, organizational culture, digital maturity, cybersecurity readiness and financial resources, examine alternative mediators such as innovation and organizational agility, and incorporate objective indicators such as revenue

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Volume 4 • Issue 4 • August 2026

growth, productivity, costs, energy consumption, employee turnover, customer retention, and innovation outputs.

12. Conclusion

This study examined how GenAI capability relates to SME digital transformation and sustainable business performance in Pakistan. The reported findings indicate positive relationships between GenAI capability and both digital transformation and sustainable performance, while digital transformation has a strong positive association with sustainable performance. The significant mediation effect indicates that the strategic value of GenAI is realized substantially through organizational transformation. For Pakistani SMEs, the key implication is that sustainable GenAI value depends not simply on adopting AI tools, but on developing the technological, human, organizational, strategic, and governance capabilities needed to embed GenAI within broader digital transformation.

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ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 4 • August 2026

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