DIGITAL TRANSFORMATION AND SME PERFORMANCE: EVIDENCE FROM PUNJAB, INDIA

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Abstract

Purpose/Objective*: This study investigates the relationship between digital transformation adoption and performance outcomes among small and medium enterprises (SMEs) in Punjab, India.*

Design/Methodology/Approach*: A quantitative research design was employed, using a structured questionnaire administered to 350 SME owners and managers across five industrial clusters in Punjab. Data were analysed using structural equation modelling (SEM) via AMOS 26.0.*

Findings: *The results reveal that digital transformation, encompassing cloud computing, e-commerce integration, and digital marketing adoption, has a significant positive effect on SME financial performance ($\beta = 0.61$, $p < .001$) and operational efficiency ($\beta = 0.54$, $p < .001$). Managerial digital literacy moderates this relationship significantly.*

Research Limitations/Implications*: The cross-sectional design limits causal inference. Future longitudinal studies should examine dynamic changes in digital adoption. The findings have direct implications for policymakers designing SME digitalisation support schemes.*

Originality/Value*: This paper contributes an empirically validated framework linking digital transformation dimensions to dual performance metrics in the Indian SME context, extending existing models from developed economy settings.*

Keywords: *Digital Transformation; Managerial Digital Literacy; Operational Efficiency; SME Performance; Structural Equation Modelling*

1. INTRODUCTION

Small and medium enterprises (SMEs) constitute the backbone of the Indian economy, contributing approximately 30% of GDP and employing over 110 million people (Ministry of MSME, 2023). Despite their economic significance, Indian SMEs lag substantially behind their counterparts in developed economies in the adoption of digital technologies. This gap has widened following the COVID-19 pandemic, which accelerated digital disruption across all business sectors (Kumar et al., 2023).

Digital transformation broadly defined as the integration of digital technology into all areas of a business, fundamentally changing how it operates and delivers value to customers has emerged as a critical strategic imperative (Vial, 2019). However, the empirical evidence on how digital transformation affects SME performance in the Indian context remains sparse and inconclusive.

This study addresses this gap by examining the impact of three digital transformation dimensions cloud computing adoption, e-commerce integration, and digital marketing on two performance outcomes: financial performance and operational efficiency. Additionally, the moderating role of managerial digital literacy is explored, extending the theoretical framework of Bharadwaj et al. (2013) to the SME context in Punjab, India.

The remainder of the paper is structured as follows: Section 2 reviews the relevant literature and develops the hypotheses; Section 3 describes the research methodology; Section 4 presents the results and analysis; Section 5 discusses the findings; and Section 6 concludes with practical and policy implications.

2. LITERATURE REVIEW

2.1 Digital Transformation in SMEs

Digital transformation is a multi-dimensional construct encompassing technological, organisational, and strategic change (Matt et al., 2015). While large corporations have been the primary focus of digital transformation research, scholars have increasingly recognised that SMEs face unique challenges and opportunities in this domain (Moeuf et al., 2018). Barriers such as limited capital, shortage of skilled human resources, and low technology awareness constrain SME digital adoption (Ghobakhloo & Tang, 2019).

In the Indian context, Tiwari and Buse (2021) documented that fewer than 25% of Indian SMEs had adopted cloud-based enterprise solutions by 2020, despite proven productivity

benefits. Sharma and Verma (2022) further established that SMEs with higher digital maturity scores demonstrated 18% higher revenue growth compared to digitally nascent peers, underscoring the performance premium of digital transformation.

2.2 Performance Outcomes and Hypothesis Development

Existing literature broadly categorises SME performance outcomes into financial performance (revenue growth, profitability) and operational performance (process efficiency, cost reduction) (Richard et al., 2009). Digital technologies are theorised to enhance both dimensions through reduced transaction costs, improved information processing, and enhanced market reach (Bharadwaj et al., 2013).

Building on the resource-based view (Barney, 1991) and dynamic capabilities framework (Teece, 2007), we posit that digital transformation constitutes a strategic capability that enables SMEs to reconfigure resources for superior performance. Accordingly, the following hypotheses are advanced:

H1: Digital transformation has a significant positive effect on SME financial performance.

H2: Digital transformation has a significant positive effect on SME operational efficiency.

H3: Managerial digital literacy positively moderates the relationship between digital transformation and SME performance.

3. RESEARCH METHODOLOGY

3.1 Research Design and Sampling

This study adopts a quantitative, cross-sectional research design. The target population comprised all registered SMEs in five major industrial clusters in Punjab, India: Ludhiana, Jalandhar, Amritsar, Patiala, and Phagwara. A stratified random sampling approach was employed to ensure proportional representation across sectors (manufacturing, services, and retail). Ethics approval was obtained from the Institutional Ethics Committee, GNA University (Approval No. GNA/IEC/2024/017). Informed consent was obtained from all participants prior to data collection.

A sample size of 350 was determined using G*Power 3.1, based on a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power = 0.80 for the SEM analysis. Surveys were administered via personal interview-assisted questionnaire between October and December 2024. A total

of 378 questionnaires were distributed, of which 350 were deemed complete and valid for analysis, yielding a response rate of 92.6%.

3.2 Measures and Instrument Validity

All constructs were measured using validated multi-item scales on a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Digital transformation was operationalised using a 12-item scale adapted from Vial (2019). Financial performance and operational efficiency were measured using six-item and five-item scales respectively, adapted from Richard et al. (2009). Managerial digital literacy was assessed using a four-item scale adapted from Tiwari and Buse (2021). Confirmatory factor analysis (CFA) confirmed adequate construct validity; all factor loadings exceeded 0.60 and Average Variance Extracted (AVE) values surpassed the 0.50 threshold (see Table 1).

Table 1: Reliability and Validity Statistics for Measurement Constructs

Construct	Items	Cronbach's α	AVE	CR
Digital Transformation	12	.891	.563	.912
Financial Performance	6	.874	.541	.883
Operational Efficiency	5	.856	.524	.864
Managerial Digital Literacy	4	.812	.518	.821

Note. AVE = Average Variance Extracted; CR = Composite Reliability; α = Cronbach's Alpha.

4. RESULTS AND ANALYSIS

4.1 Descriptive Statistics

Table 2 presents the demographic profile of the survey respondents. The sample comprised 350 SME owners and managers, of whom 68.3% were male. The majority of respondents (54.3%) operated in the manufacturing sector, followed by services (32.0%) and retail (13.7%). The mean years of operation was 11.4 years (SD = 6.8). As shown in Table 2, annual turnover ranged broadly, with 41.4% of firms reporting turnover between INR 10 to 50 lakhs.

Table 2: Demographic Profile of Survey Respondents (N = 350)

Characteristic	Category	Frequency (%)
Gender	Male	239 (68.3%)
	Female	111 (31.7%)
Sector	Manufacturing	190 (54.3%)
	Services	112 (32.0%)

	Retail	48 (13.7%)
Annual Turnover	< INR 10 Lakhs	63 (18.0%)
	INR 10–50 Lakhs	145 (41.4%)
	> INR 50 Lakhs	142 (40.6%)

4.2 Structural Equation Modelling Results

The structural model demonstrated acceptable fit indices: $\chi^2/df = 2.31$, CFI = .956, TLI = .948, RMSEA = .061 (90% CI: .048–.074), SRMR = .052. These values satisfy the conventional thresholds recommended by Hair et al. (2019). Table 3 presents the standardised path coefficients and significance levels for all hypothesised relationships.

Table 3: Results of Structural Equation Modelling — Path Coefficients

H	Path	β	SE	p
H1	Digital Transformation → Financial Performance	.61	.048	< .001***
H2	Digital Transformation → Operational Efficiency	.54	.052	< .001***
H3	Digital Transformation × Mgr. Literacy → Performance	.29	.061	.003**

*Note. β = Standardised path coefficient; SE = Standard Error. **p < .01; ***p < .001.*

All three hypotheses were supported. Digital transformation exerted a strong positive effect on both financial performance (H1: β = .61, p < .001) and operational efficiency (H2: β = .54, p < .001), supporting H1 and H2. The moderation analysis confirmed that managerial digital literacy significantly strengthened the digital transformation–performance relationship (H3: β = .29, p = .003), lending support to H3. Figure 1 illustrates the conceptual framework with the empirically derived path coefficients (see Figure 1).

[Figure 1: Structural Model with Standardised Path Coefficients — Insert diagram here]

Figure 1: Conceptual Framework with Empirical Path Coefficients

5. DISCUSSION

The findings of this study provide compelling empirical support for the proposition that digital transformation drives SME performance improvement in the Punjab context. The strong positive path coefficient from digital transformation to financial performance (β = .61) aligns with Sharma and Verma (2022), who documented 18% higher revenue growth in digitally mature Indian SMEs. This effect is notably larger than the coefficients reported by Ghobakhloo and Tang (2019) in their Malaysian SME study (β = .43), suggesting that

the performance premium of digital adoption may be higher in emerging market contexts where the competitive differentiation conferred by technology is greater.

The significant moderation by managerial digital literacy (H3) is a particularly noteworthy finding. This implies that the returns from digital investment are not uniform across SMEs; rather, they are amplified when managers possess the cognitive and technical competencies to leverage digital tools strategically. This finding resonates with the dynamic capabilities perspective (Teece, 2007), which emphasises that technological resources must be actively orchestrated by managerial agency to yield competitive advantage.

The operational efficiency finding (H2: $\beta = .54$) further indicates that digitalisation yields tangible process-level benefits — reduced turnaround times, automated workflows, and improved inventory management — that translate into cost savings and agility. These benefits are especially salient for Punjab's manufacturing SME clusters, where supply chain disruptions during the pandemic exposed deep operational vulnerabilities.

6. CONCLUSION

This study makes three principal contributions to the SME digitalisation literature. First, it provides empirically validated evidence, using SEM in a large-scale Indian SME sample, that digital transformation significantly enhances both financial performance and operational efficiency. Second, it establishes managerial digital literacy as a critical moderator, highlighting the importance of human capital alongside technological investment. Third, it extends existing theoretical frameworks — primarily developed in Western or East Asian contexts — to the Indian SME ecosystem.

From a policy perspective, the findings underscore the need for government-sponsored digital literacy programmes targeted at SME owners and managers, particularly in tier-2 and tier-3 industrial cities. Subsidy schemes for digital infrastructure adoption should be paired with management development interventions to maximise returns on public investment.

Limitations of this study include its cross-sectional design and geographic restriction to Punjab. Future research should adopt longitudinal designs to establish causal direction and expand the geographic scope to other Indian states. Qualitative studies exploring the mechanisms through which managerial digital literacy moderates performance outcomes would also add theoretical depth.

Conflict of Interest Statement

The authors declare no conflict of interest.

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