

Digital Transformation Adoption Among SMEs in Developing Economies: Evidence from Nawalparasi District, Nepal



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Abstract

Small and medium-sized enterprises play a vital role in economic development in developing countries, yet structural, institutional, and organizational challenges often constrain their progress toward digital transformation. This study examines the factors influencing the adoption of digital transformation among SMEs in Nawalparasi, focusing on four dimensions: business environment, innovation, digital capabilities, and digital tools. The study is grounded in the Technology–Organization–Environment framework, the Technology Acceptance Model, and Innovation Diffusion Theory. Using a quantitative cross-sectional survey design, data were collected from 237 SME owners, managers, and employees. Yamane’s sampling formula was applied to determine the sample size from a population of 27,300 registered SMEs, and the data were analyzed using descriptive statistics, Pearson correlation, and multiple linear regression with IBM SPSS Statistics 27.

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The findings indicate that digital tools and innovation are the two significant predictors of digital transformation adoption among SMEs. Digital tools emerged as the strongest predictor, demonstrating that firms with greater access to and use of digital technologies are more likely to adopt digital transformation practices. Innovation also showed a positive and significant influence, suggesting that organizations with a stronger culture of experimentation and openness to change are more inclined to adopt digital technologies. In contrast, the business environment and digital capabilities did not independently predict firm-level adoption. Although digital capabilities were statistically not significant in the regression model, they had the lowest mean, highlighting major deficiencies in digital strategy, workforce training, and organizational readiness among SMEs in Nawalparasi. A notable finding of the study is the paradox between organizational preparedness and perceived outcomes. Despite weaknesses in strategic capability and training, respondents expressed strong satisfaction with the outcomes of digital transformation. This suggests that SMEs are experiencing the immediate benefits of digitalization while still lacking the deeper organizational infrastructure required for sustainable transformation.

Keywords: Business environment, digital capabilities, digital transformation, digital tools, developing economy, innovation, SMEs.

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1. Introduction

Small and medium-sized enterprises (SMEs) are central to economic growth, employment, and innovation in both developed and developing economies (OECD, 2021). As global markets undergo rapid digitalization, digital transformation, defined as the systematic integration of technologies such as cloud computing, artificial intelligence, and digital marketing into core business operations (Matt et al., 2015), has become a strategic imperative for SMEs seeking sustained competitiveness and viability (Vial, 2019). However, this transition is far from uniform. SMEs in developing-country contexts face compounding barriers: limited digital infrastructure, insufficient financial resources, low organizational digital literacy, and persistent resistance to change (Morakanyane et al., 2020). These conditions make digital transformation adoption substantially more complex than it appears in high-resource settings.

Despite growing scholarly interest in digital transformation, empirical research targeting SMEs in low-resource contexts, particularly Nepal, remains critically limited (Vrontis et al., 2022; Amaral & Peçab, 2020). Existing literature disproportionately catalogs barriers such as cost, digital ignorance, and organizational inertia (Khan & Siddiqui, 2023; Arifia, 2024), while neglecting the enabling conditions of government support, digital literacy programs, and technology partnerships that could meaningfully accelerate adoption (Jiang, 2024). In Nawalparasi District, where SMEs underpin local employment and economic activity, this gap is particularly consequential. External factors, including infrastructure quality, market dynamics, and regulatory frameworks, further mediate whether adoption is enabled or constrained (Nambisan et al., 2019). However, their interaction with firm-level vulnerabilities in this context has not been systematically examined.

To rigorously address this gap, the study integrates three complementary frameworks. The Technology–Organization–Environment (TOE) framework (Tornatzky & Fleischer, 1990) provides an overarching structural lens for explaining how technological availability, organizational readiness, and environmental pressures jointly shape adoption decisions. The Technology Acceptance Model (TAM; Davis, 1989) captures the cognitive and attitudinal dimensions of adoption, showing how perceived usefulness and perceived ease of use, both of which are critically constrained by low digital literacy in Nawalparasi, determine whether SME owners and managers embrace or resist digital tools. Innovation Diffusion Theory (IDT; Rogers, 2003) completes the framework by attending to social and systemic dynamics: low observability of digital success cases and poor compatibility with informal business practices are expected to slow diffusion, while peer networks and demonstration initiatives could enhance relative advantage and accelerate uptake.

2. Review of Literature

Four interrelated dimensions shape the adoption of digital transformation among SMEs: the business environment, innovation capacity, digital capabilities, and digital tool accessibility. Externally, market competition, regulatory requirements, and government financial incentives create the conditions under which SMEs either embrace or resist digital solutions (Bhuiyan et al., 2024; Kahveci, 2025). Access to foundational infrastructure, particularly internet connectivity and cloud computing services, further determines whether the transition to digital operations is practically achievable (OECD, 2021). Internally, SMEs that cultivate an innovation-oriented culture demonstrate a greater willingness to adopt digital tools, and those that do consistently outperform peers on competitiveness and market reach (Cannas, 2021; Rogers, 2021). This innovation-adoption relationship is bidirectional: digital technologies simultaneously respond to and stimulate organizational innovation, reinforcing broader growth (Vrontis et al., 2022). However, the realization of these gains is contingent on digital capabilities, specifically, the technical literacy and IT competency of both staff and leadership (Bhuiyan et al., 2024). Where capability gaps persist, structured training and executive commitment become decisive enablers (Ghanim et al., 2022; Scuotto et al., 2017). At the operational level, tools such as cloud computing, artificial intelligence, ERP systems, CRM platforms, and digital marketing technologies translate transformation ambitions into measurable efficiency and customer engagement gains, though budget constraints and data security concerns remain persistent barriers to full utilization (Philbina et al., 2022; Bhuiyan et al., 2024).

These four dimensions are theoretically anchored in two complementary frameworks. The Technology–Organization–Environment framework (Tornatzky & Fleischer, 1990) provides the overarching structural lens, positing that digital adoption is jointly determined by three contexts: the technological context — encompassing the availability and perceived usefulness of digital tools (Zhu et al., 2006); the organizational context covering leadership commitment, digital literacy, financial capacity, and culture (Low et al., 2011; Vial, 2019); and the environmental context reflecting competitive market pressures, consumer expectations, and regulatory frameworks (Baker, 2012; OECD, 2020). Complementing TOE at the social and perceptual level, Rogers's (2003) Diffusion of Innovation (DOI) theory explains how the rate of digital adoption within SME communities is shaped by five innovation attributes: relative advantage, compatibility, complexity, trialability, and observability. In the context of Nawalparasi, the low observability of digital success cases and poor compatibility with established informal business practices are expected to slow diffusion. At the same time, government-supported demonstration initiatives and peer knowledge exchange could meaningfully accelerate uptake (Jiang, 2024).

Nepalese empirical studies validate these theoretical expectations while underscoring the depth of remaining challenges. Adhikari and Molla (2024) found that digitalization significantly improved decision-making, customer responsiveness, and internal collaboration among Nepalese SMEs, confirming the operational value of digital tools when effectively deployed. At the intervention level, a UNCDF- and SDC-supported program enhanced the digital and financial capacities of over 4,000 Nepalese SMEs, particularly women-led enterprises, by facilitating access to digital markets and targeted capacity building, thereby directly operationalizing TOE's organizational context (UNCDF, 2023). District-level digital literacy training delivered by FWEAN across Nawalparasi, Ilam, and Palpa further reduced capability gaps and expanded market access for participating entrepreneurs (Chapagain, 2023).

3. Research Methodology

This study used a quantitative, descriptive research design to examine the factors influencing the adoption of digital transformation among SMEs in Nawalparasi District (Aervina Misron et al., 2025; Pratamansyah, 2024). A cross-sectional survey approach is employed, enabling simultaneous data collection across a diverse sample of SME owners, managers, and employees at a single point in time. This design is well-suited to the study's objective of assessing how four independent variables, business environment, innovation, digital capabilities, and digital tools, collectively influence the dependent variable of digital transformation adoption. The quantitative approach ensures that relationships between variables are measured with statistical precision, producing findings that are both replicable and generalizable to the broader SME population in the district.

Primary data were collected directly from key organizational informants, specifically SME owners, managers, and senior employees, who possess firsthand knowledge of their firms' digital practices and strategic orientations. This approach is consistent with established precedent. Rupeika-Apoga et al. (2022) prioritized organizational decision-makers when examining digital capability in transformation adoption, whereas Teng et al. (2022) employed comparable data-sourcing strategies in their investigation of innovation as an adoption driver. Targeting respondents with direct organizational authority ensures that responses accurately reflect firm-level realities rather than peripheral or secondhand perceptions.

The study population comprises all registered SMEs in Nawalparasi District, spanning three operational categories: manufacturing, retail, and tourism, with an estimated total of 27,300 enterprises (Economic Survey, 2080/81, Ministry of Industry, Commerce and Supplies). To determine an adequate and statistically defensible sample size, Yamane's (1967) formula was applied at a 5% margin of error. This calculation yielded a required sample size of 394, sufficient to ensure statistical significance and representativeness across the SME population. Respondents were selected using convenience sampling, a non-probability method chosen for its practical efficiency, given the study's resource and time constraints, a technique widely employed in SME research operating under similar field conditions. Data were collected using a structured questionnaire comprising 25 items, measured on a five-point Likert scale, developed from validated scales in prior empirical

research. A total of 410 questionnaires were administered using a dual-mode approach: Google Forms for digital distribution and printed copies for respondents who preferred physical formats, to maximize accessibility and response rates. Of the 410 distributed, 243 responses were returned, yielding a response rate of approximately 59%. Following rigorous screening for completeness and internal consistency, 237 questionnaires were deemed valid and retained for analysis, constituting the final analytical sample.

Three analytical techniques are applied to the 237 valid responses using IBM SPSS Statistics 27 at a significance level of .05. First, descriptive statistics, including frequencies, percentages, means, and standard deviations, summarize the demographic profile of respondents and reveal the central tendencies and distributional patterns within each variable. Second, Cronbach's Alpha assesses the internal consistency and reliability of all measurement scales, with $\alpha > .70$ adopted as the benchmark for acceptable reliability, thereby confirming that each construct consistently measures its intended dimension (Hair et al., 2019). Third, and most centrally, multiple linear regression analysis is employed to test the directional relationships between the four independent variables, business environment, innovation, digital capabilities, and digital tools, and the dependent variable of digital transformation adoption.

4. Results

Among the independent variables, Innovation recorded the highest overall mean score, with a mean of 3.75, indicating that SMEs generally perceive innovation as a strong contributor to digital transformation, particularly in enabling innovative products and services, which achieved a mean of 3.83 and a standard deviation of 0.914. Digital Tools achieved a mean of 3.51, while Business Environment recorded a mean of 3.47, both scoring above the midpoint of the scale and suggesting above-average support from technological resources and external environmental conditions. Within the Business Environment construct, government policies encouraging digital innovation received the highest rating, with a mean of 3.61 and a standard deviation of 1.063. In contrast, digital infrastructure adequacy received a lower rating, with a mean of 3.31 and a standard deviation of 1.176. In contrast, Digital Capabilities produced the lowest overall mean score of 2.89, falling below the midpoint and indicating insufficient internal digital readiness among SMEs. Employee digital skills and competencies achieved the highest score within this construct, with a mean of 3.11 and a standard deviation of 1.279. In contrast, the presence of a clear digital transformation strategy received the lowest score, with a mean of 2.68 and a standard deviation of 1.251. The dependent variable, Digital Transformation Adoption, achieved the highest overall mean score in the study, with a mean of 4.38 and relatively low standard deviation values ranging from 0.616 to 0.750, reflecting strong and consistent agreement among respondents that digital transformation initiatives have been successfully implemented and have generated measurable organizational benefits, including increased revenue and profitability.

Table 1 presents the Pearson correlation matrix among the study variables. Digital Tools demonstrated the strongest significant positive relationship with digital transformation adoption (ADT), with a correlation coefficient of 0.355 and a significance level below 0.01, indicating that greater use of digital tools is associated with higher levels of ADT. Innovation also showed a significant positive correlation with ADT ($r = 0.278$, $p < 0.01$), suggesting that innovative practices contribute positively to digital transformation efforts.

Table 1 : Pearson Correlation Matrix Among Study Variables (n = 237)

Variable	ADT	BE	DC	I	DT
ADT Digital Transformation Adoption	1				
BE Business Environment	.006	1			
DC Digital Capabilities	.083	.018	1		
I Innovation	.278**	-.132*	.284**	1	
DT Digital Tools	.355**	-.078	.507**	.431**	1

** $p < .01$ (2-tailed); * $p < .05$ (2-tailed).

In contrast, Digital Capabilities exhibited a weak, statistically non-significant relationship with ADT ($r = 0.083$, $p > 0.05$), while Business Environment showed an almost negligible, non-significant correlation ($r = 0.006$). Additionally, a strong positive intercorrelation was observed between Digital Tools and Digital Capabilities, with a correlation coefficient of 0.507 and a significance level below 0.01, indicating the possibility of multicollinearity that required further examination in the regression analysis. Furthermore, Business Environment and Innovation showed a significant negative correlation ($r = -0.132$, $p < 0.05$), suggesting that certain external environmental conditions may hinder rather than encourage innovation within SMEs.

Table 2 shows the overall model fit statistics and the regression coefficients. The regression model was statistically significant, indicating that the set of predictors collectively had a meaningful effect on digital transformation adoption. The model explained 16.5% of the variation in digital transformation adoption. At the same time, the adjusted value showed that about 15.0% of the variance remained explained after accounting for the number of predictors included in the model.

Table 2 : Regression Model Summary and Coefficients

Model Fit: $R = .406$, $R^2 = .165$, Adjusted $R^2 = .150$, $F(4, 232) = 11.429$, $p < .001$					
Predictor	B	SE	β	t	p
(Constant)	14.204	1.408	—	10.086	< .001
Business Environment	.043	.043	.060	.993	.322
Digital Capabilities	-.087	.040	-.151	-2.153	.032
Innovation	.138	.054	.173	2.574	.011
Digital Tools	.321	.066	.362	4.869	< .001

Among the predictors, Digital Tools emerged as the strongest and most significant factor influencing digital transformation adoption. This indicates that organizations that used digital tools more extensively were more likely to adopt digital transformation practices. Innovation was also found to have a positive and significant effect, suggesting that firms with stronger innovative practices tend to adopt digital transformation more actively.

Digital Capabilities showed a statistically significant but negative relationship with digital transformation adoption. This negative effect is most likely due to suppression effects caused by the strong correlation between Digital Capabilities and Digital Tools, rather than indicating that digital capabilities genuinely reduce adoption. In other words, the overlap between these two variables may have distorted the sign of the coefficient in the regression model. Business Environment was the only predictor that did not have a statistically significant effect. This suggests that external factors, such as market conditions and regulatory influences, do not independently determine the adoption of digital transformation when internal organizational factors are taken into account.

Table 3 presents the results of all four research hypotheses. The findings showed that Hypothesis 4 received the strongest empirical support, indicating that the availability and use of digital tools are the most important determinants of digital transformation adoption among SMEs in Nawalparasi. This means that firms with better access to and utilization of digital tools are more likely to adopt digital transformation practices.

Table 3 : Hypothesis Testing Summary

Hypothesis	β	p	Decision
H1: Business environment has a significant positive relationship with digital transformation adoption.	.060	.322	Not Supported
H2: Innovation has a significant positive impact on the adoption of digital transformation.	.173	.011	Supported
H3: Higher digital capabilities are positively associated with digital transformation adoption.	-.151	.032	Not Supported
H4: Digital tools significantly and positively influence digital transformation adoption.	.362	< .001	Supported

Hypothesis 2 was also supported, confirming that innovation orientation has a significant and positive influence on digital transformation adoption. The result suggests that organizations that encourage innovation and new ideas are more likely to engage in digital transformation activities. Hypothesis 1 was not supported because the business environment did not have an independent effect on digital transformation adoption after accounting for internal organizational variables. This implies that external conditions, such as market competition or regulatory factors, may be less influential than internal organizational factors. Hypothesis 3 was also not supported in the expected direction. Although digital capabilities showed a statistically significant relationship with digital transformation adoption, the coefficient was negative rather than positive. This negative relationship is interpreted as a statistical suppression effect caused by overlap with other predictor variables, rather than indicating that digital capabilities actually reduce digital transformation adoption.

5. Discussion

The findings support earlier studies showing that technologies such as cloud computing, CRM systems, e-commerce platforms, and AI applications significantly improve operational efficiency, customer engagement, and organizational performance (Bhuiyan et al., 2024; Philbina et al., 2022). The study confirmed that SMEs with greater access to and use of digital tools were more likely to adopt digital transformation practices. However, although respondents rated IT support quality and tool user-friendliness highly, the use of advanced technologies such as ERP, CRM, and AI systems remained relatively low. This suggests that many SMEs are still limited to basic digitalization rather than comprehensive digital transformation. Consistent with the Technology–Organization–Environment (TOE) framework, the findings indicate that technological resources may exist in principle but are difficult to implement fully due to financial and capability constraints (Tornatzky & Fleischer, 1990; Zhu et al., 2006). Innovation emerged as the second significant predictor of digital transformation adoption. This finding aligns with previous research showing that innovation-oriented organizations are more willing to experiment with and adopt digital technologies (Cannas, 2021; Rogers, 2021). Respondents acknowledged that innovation supports creativity and the development of new products and services. However, innovation's contribution to competitive advantage was rated comparatively lower. This contrasts with findings by Vrontis et al. (2022), who reported that digital innovation often produces visible competitive benefits. The weaker perception of competitive advantage in this study may reflect the early stage of digital transformation among SMEs in Nawalparasi, where innovation benefits are experienced internally but have not yet translated into clear market differentiation. The business environment produced a non-significant result despite being positively perceived by respondents. This finding differs from earlier studies that identified competitive pressure, government incentives, and regulatory frameworks as important drivers of digital adoption (Baker, 2012; Premkumar, 2003). The likely explanation is that SMEs within the district operate under similar environmental and infrastructural conditions, reducing the variability needed for environmental factors to predict adoption. Therefore, internal organizational factors appear to play a more decisive role than external conditions in explaining differences in adoption among firms. Digital capabilities showed a statistically significant but negative relationship with digital transformation adoption. This result contradicts prior studies that identified digital literacy, technical competency, and leadership commitment as essential drivers of digital transformation (Bhuiyan et al., 2024; Scuotto et al., 2017; Vial, 2019). However, the negative coefficient is interpreted as a statistical suppression effect arising from the strong interrelationship between digital capabilities and digital tools, rather than a genuine inhibitory relationship. Despite this statistical issue, the findings revealed substantial capability gaps among SMEs, particularly in strategic planning and employee training.

6. Conclusion

Grounded in the TOE framework, the Technology Acceptance Model, and Innovation Diffusion Theory, the findings demonstrate that digital transformation is driven more by internal organizational dynamics than by external environmental conditions. In particular, digital tools emerged as the strongest predictor of adoption, while innovation orientation also showed a significant positive influence. These findings reinforce the argument

that SMEs adopt digital transformation not simply because technology is available, but because firms possess the willingness and organizational culture needed to integrate technology into business operations. At the same time, the study reveals a critical structural contradiction within the digitalization process. Although SMEs reported strong satisfaction with the outcomes of digital transformation, the organizational foundations needed to sustain it remain weak. Advanced digital technologies such as ERP, CRM, and AI systems were still underutilized, and many firms lacked formal digital strategies and structured employee training programs. This suggests that current digital adoption in Nawalparasi is relatively shallow and operational rather than deeply strategic. The findings, therefore, challenge overly optimistic assumptions that technology adoption alone guarantees transformation success. Instead, they highlight that digital transformation is an ongoing organizational capability-building process rather than a one-time technological shift.

The non-significant effect of the business environment also contributes an important theoretical refinement to existing literature. While prior studies frequently identify regulatory support, infrastructure, and competitive pressure as major drivers of adoption, this study demonstrates that environmental factors may lose explanatory power when firms operate under relatively homogeneous conditions. This suggests that external factors may function more as background enablers than as direct firm-level differentiators in geographically concentrated contexts. Consequently, the study refines the TOE framework by emphasizing that the predictive role of environmental conditions may depend heavily on contextual variability. Another analytically important finding is the negative coefficient for digital capabilities, which is interpreted as a statistical suppression effect rather than a substantive negative relationship. However, beneath this statistical artifact lies a deeper practical issue: SMEs continue to face significant capability deficits in strategic planning, digital literacy, and workforce preparedness. The findings, therefore, expose a “capability–tool paradox,” in which firms recognize the value of digital technologies but lack the organizational readiness to exploit them fully. This paradox is particularly characteristic of developing-economy SMEs, where digitalization often advances faster than the development of institutions and human capacity.

Limitations and Directions for Future Research

Like all empirical studies, this research is subject to a number of limitations that should be considered when interpreting its findings and that collectively point toward productive directions for future inquiry. This study adopts a cross-sectional design, meaning data were collected at a single point in time. While this approach is appropriate for identifying patterns and associations, it does not permit causal inference or capture the evolution of digital transformation adoption over time. Future studies should consider longitudinal designs that track SMEs across multiple time periods, enabling researchers to observe whether adoption deepens, stalls, or reverses as organizational conditions and the broader digital ecosystem change.

The geographic scope of this study is limited to Nawalparasi District, a deliberate boundary that allowed for contextual depth but constrains the generalizability of the findings. The non-significance of the business environment as a predictor is itself partly a product of this boundary; within a single district, regulatory, infrastructural, and market conditions are too uniform to generate sufficient variability for predictive analysis. Expanding the sampling frame to include multiple districts or provinces across Nepal, or conducting comparative analyses across districts with varying levels of digital infrastructure, would substantially strengthen the external validity of the findings and enable environmental factors to be more rigorously tested as predictors of adoption.

This study relies exclusively on self-reported perceptual data gathered through a structured questionnaire. While the measurement scales were drawn from validated instruments and Cronbach's Alpha confirmed acceptable reliability across all constructs, self-report data are inherently susceptible to social desirability bias, particularly on questions concerning organizational competence and strategic readiness. Future research would benefit from triangulating survey data with qualitative methods, such as in-depth interviews with SME owners and managers or case-study analyses of firms at different stages of digital adoption, to add interpretive richness and reduce reliance on single-source measures.

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Conflict of Interest

The author declares no conflict of interest in the preparation and publication of this article.

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