



DIGITAL CAPABILITY AND MSME PERFORMANCE IN BAUCHI STATE, NIGERIA. DOES ENTREPRENEURIAL SKILL MATTER

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ABSTRACT

Micro, small, and medium enterprises (MSMEs) form a major share of employment and economic output in Nigeria, yet many MSMEs in Bauchi State continue to record weak and unstable performance despite growing digitalisation pressure. This study examines the association of digital capability with MSME performance and the role of entrepreneurial skills among MSME owner-managers in Bauchi State, Nigeria. Drawing on Dynamic Capabilities Theory and Human Capital Theory, the study hypothesizes that digital capability is associated with MSME performance both directly and indirectly through the entrepreneurial skills with which it is linked. Data were collected from a sample of MSME owner-managers in Bauchi State and analysed using regression-based mediation analysis via Hayes' PROCESS macro in SPSS. The findings show that digital capability is significantly associated with MSME performance both directly and indirectly, with entrepreneurial skills partially mediating the relationship and accounting for the larger share of digital capability's overall statistical association with performance. The study offers an integrated capability-based account of how firm-level digital competency is associated with MSME performance primarily through the entrepreneurial behaviour with which it is linked, with implications for MSME support policy and business development services in resource-constrained Nigerian contexts.

Introduction

Micro, small, and medium enterprises (MSMEs) make up about 90 per cent of businesses globally, providing 60-70 per cent of jobs and contributing nearly half of global gross domestic product, forming the backbone of inclusive growth, job creation, and livelihood sustainability worldwide (United Nations, 2025). In Nigeria, MSMEs are similarly central to economic development, accounting for nearly 80 per cent of employment and contributing over 40 per cent of national GDP (PwC Nigeria, 2024). Their economic relevance across diverse sectors underscores the importance of understanding what shapes their performance, understood here as a multidimensional construct capturing both financial outcomes such as profitability, sales growth, and market share, and non-financial outcomes including operational efficiency, customer expansion, resilience, and competitiveness (Dess & Robinson, 1984; Venkatraman & Ramanujam, 1987).

Rapid digitalisation and intensifying market competition have become major sources of performance pressure for MSMEs. The COVID-19 pandemic significantly accelerated digital disruption across industries, reshaping consumer behaviour, competitive dynamics, and modes of value creation (Pfister & Lehmann, 2023), while digitalisation has widened performance gaps between firms with differing levels of digital readiness (UNCTAD, 2024). Nigerian MSMEs now operate in environments where customers increasingly expect online presence, digital payment options, and responsive digital engagement (PwC Nigeria, 2024), and firms that fail to adapt face high risks of declining competitiveness. Yet evidence suggests that performance gains from digitalisation are not automatic (Hariyanti & Kristanti, 2024): many MSMEs face persistent constraints, including limited digital skills, inadequate awareness of digital tools, restricted access to finance, and institutional and infrastructural weaknesses (World Bank Group, 2022), leaving digital adoption among Nigerian MSMEs uneven across sectors, firm sizes, and geographic locations (Small and Medium Enterprises Development Agency of Nigeria & The FATE Institute, 2022).

These patterns indicate that the key issue is not merely whether MSMEs adopt digital technologies, but whether they possess the internal capacity to use them productively, bringing digital capability, the skills, knowledge, attitudes, routines, and learning processes that enable firms to effectively deploy, integrate, and leverage digital technologies in pursuit of strategic and operational objectives (Folagbade et al., 2024; Freitas Junior et al., 2024) to the forefront as a critical firm-level determinant of MSME performance. From a dynamic capability perspective, digital capability enables firms to sense digital opportunities, seize them through appropriate investments, and reconfigure internal processes in response to environmental change (Al-Omush et al., 2023). Empirical evidence shows that MSMEs with stronger digital capability achieve superior performance outcomes, including improved operational efficiency, enhanced customer engagement, wider market exposure, and greater resilience to environmental shocks (Blanza & Catilo, 2025; Tarigan et al., 2025).

However, accumulating evidence suggests that digital capability alone is insufficient to guarantee improved performance, as its association with performance depends on the presence of complementary organisational and entrepreneurial mechanisms. Studies grounded in the dynamic capability perspective show that digital technologies are associated with performance benefits primarily when firms possess the skills and capabilities required to sense opportunities, make strategic decisions under uncertainty, and reconfigure resources accordingly (Teece, 2007; Li, Tong, Wei, & Yang, 2022). In the context of MSMEs, entrepreneurial skills such as opportunity recognition, innovation orientation, risk management, and proactive market engagement play a critical role in shaping how digital capabilities are mobilised and translated into market action (Man et al., 2002), particularly in resource-constrained and institutionally challenging environments such as Nigeria (PwC Nigeria, 2024).

Building on these insights, this study argues that the performance of MSMEs in Bauchi State is best explained by the influence of digital capability through entrepreneurial skills, rather than by digital adoption or transformation alone. Despite the economic importance of MSMEs in Bauchi State, many continue to experience weak and unstable performance, reflected in limited market reach, low productivity, and vulnerability to competitive and environmental shocks, pressures that intensify as digitalisation reshapes business environments. Although digital technologies are widely promoted as a means of improving MSME performance, evidence shows that digital adoption alone does not guarantee positive outcomes; the core challenge lies not in technology access, but in the firm-level capabilities required to use digital tools effectively, and empirical evidence examining the association of digital capability with MSME performance through entrepreneurial skills remains scarce in the Nigerian context. This study addresses that gap by

examining how digital capability relates to MSME performance and the role of entrepreneurial skills in this relationship, hence the research question:

RQ: To what extent is digital capability associated with MSME performance, and to what extent do entrepreneurial skills mediate this relationship?

Theoretical Foundation and Hypotheses Development

This study draws on Dynamic Capabilities Theory (Teece et al., 1997) and Human Capital Theory (Becker, 1964; Schultz, 1961) to justify the hypothesised relationships. A single theory is insufficient to explain the phenomenon under investigation because digital capability and entrepreneurial skills operate at different levels of the firm. Dynamic Capabilities Theory operates at the organisational level, explaining how firm's sense, seize, and reconfigure resources, making it well suited to explaining digital capability as a firm-level competency, but it does not, on its own, account for the individual-level competencies of the owner-manager that determine how those firm-level capabilities are actually exercised. Human Capital Theory fills this gap by explaining performance as a function of the knowledge, skills, and experience embodied in individuals, making it well suited to explaining entrepreneurial skills as the mediating mechanism through which digital capability is translated into performance outcomes. Used together, the two theories provide a coherent, multi-level explanation, organisational capability enacted through individual competency, of how MSMEs achieve performance outcomes in a digitally competitive environment.

Digital Capability

Digital capability refers to the skills, knowledge, attitudes, routines, and learning processes that enable firms to effectively deploy, integrate, and leverage digital technologies in pursuit of strategic and operational objectives (Freitas Junior et al., 2024; Prakasa & Jumani, 2024). Within a dynamic capability perspective, digital capability is conceptualised as a firm-level dynamic competency that enables MSMEs to sense digital opportunities, seize them through the adoption and integration of digital tools, and transform business processes in ways associated with efficiency, market access, and competitiveness (Teece, 2007). Firms whose owner-managers use digital technologies to coordinate operations, respond to demand changes, and reach customers are theorised to record measurably better performance through the operational efficiency such tools provide. This is consistent with Kim and Jin (2024), who found that digital capabilities are substantially associated with SME performance, and with Prakasa and Jumani (2024), who report a significant positive association of digital capability with small business performance in Indonesia. We therefore hypothesise that:

H1: Digital capability is significantly associated with the performance of MSMEs in Bauchi State.

Beyond its direct statistical association with performance, digital capability is theorised to be strongly associated with entrepreneurial skills. MSME owner-managers who are digitally capable, comfortable using digital tools for operations, coordination, and rapid response to customer demand, are theorised to report markedly stronger opportunity recognition, risk-taking, innovativeness, strategic decision-making, and adaptability, since digital fluency is linked to expanded informational access, experimentation capacity, and strategic options (Pennetta, Anglani, & Mathews, 2024). This is documented by Wang, Wu, and Zhang (2024), who show that digital technology capability strengthens entrepreneurial alertness and opportunity recognition, and by Campos-Núñez and Serrano-Malebrán (2024), who found a synergistic interaction between information technology capability and entrepreneurial orientation. We therefore hypothesise that:

H2: Digital capability is significantly associated with entrepreneurial skills among MSMEs in Bauchi State.

Entrepreneurial Skills

Entrepreneurial skills, often operationalised as entrepreneurial competencies, encompass opportunity recognition, innovation, strategic decision-making, risk management, and adaptive response to uncertainty, competencies that enable MSME owner-managers to identify opportunities, mobilise resources, and compete effectively in dynamic environments (Man, et al., 2002; Sakib et al., 2022). Owner-managers with strong entrepreneurial skills are theorised to record correspondingly higher sales growth, profitability, operational efficiency, customer base expansion, and overall performance against expectations, since these skills directly shape decision quality, opportunity exploitation, innovation, and risk management (Becker, 1964). This is consistent with Sariwulan et al. (2020), who establish that digital literacy, economic literacy, and entrepreneurial skills are jointly foundational to entrepreneurial performance, and with Okonye et al. (2024), who confirm that entrepreneurial competencies significantly shape MSME performance in south-western Nigeria. We therefore hypothesise that:

H3: Entrepreneurial skills are significantly associated with the performance of MSMEs in Bauchi State.

Since digital capability is theorised to be associated with MSME performance both directly and through entrepreneurial skills, and entrepreneurial skills is theorised to be independently and substantially associated with MSME performance, entrepreneurial skills are positioned as the human-capital mechanism that accounts for a large part of digital capability's statistical association with performance. Owner-managers who report digital capability without complementary entrepreneurial behaviour are theorised to show only a fraction of the performance association linked to digital capability. This mediating architecture is supported by Hutama et al. (2023), who show that digital business transformation mediates the relationship between digital capability and SME performance, and by Prakasa and Juman (2024), who confirm that digital business transformation mediates the digital capability-performance relationship among Indonesian small businesses. We therefore hypothesise that:

H4: Entrepreneurial skills significantly mediate the relationship between digital capability and the performance of MSMEs in Bauchi State.

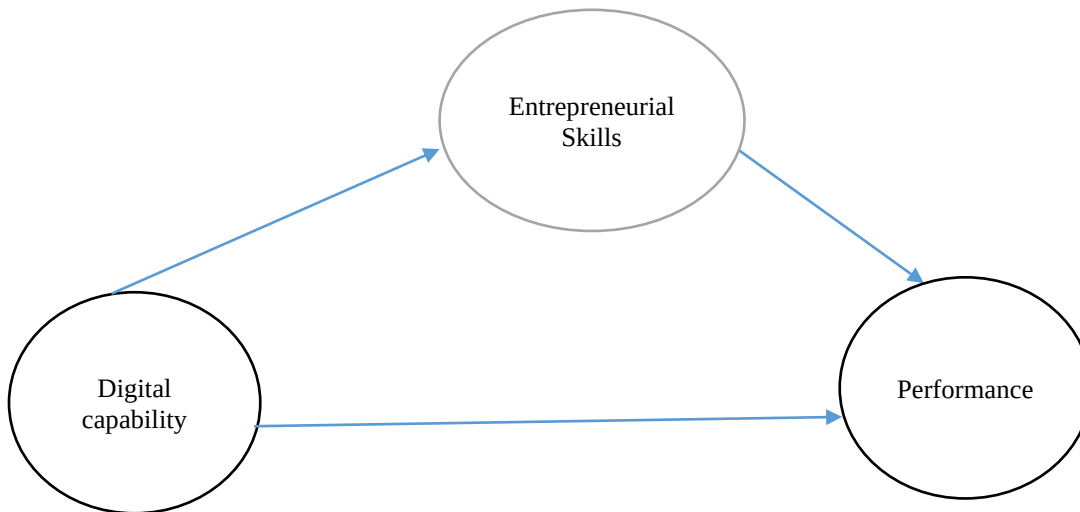


Figure 1: Conceptual Framework (Source: Researcher's Conceptual Model (2025))

Methodology

Population and Sample

The population comprised approximately 1,167,041 MSMEs operating in Bauchi State, Nigeria, encompassing both formal enterprises (34,685 registered micro, small, and medium enterprises) and informal enterprises (1,133,256, largely nano and micro businesses operating outside full regulatory registration) (SMEDAN & National Bureau of Statistics, 2021). The unit of analysis was the individual owner-manager or principal decision-maker of each enterprise, since strategic decisions relating to digital tool adoption, opportunity recognition, and performance outcomes in MSMEs are typically concentrated in the hands of the owner or lead entrepreneur. The sample size was determined using Yamane's (1967) formula for a known population at a 95 per cent confidence level and 0.05 margin of error, yielding a minimum sample of 400; this was increased by 10 per cent to 440 to accommodate anticipated non-response, consistent with recommended practice in survey research (Israel, 2013; Saunders et al., 2019). A stratified random sampling technique was adopted, with MSMEs first stratified by business sector (trade, manufacturing, services, and agribusiness) and respondents then selected within each stratum through simple random sampling. A total of 395 fully completed, valid responses were retrieved and used for analysis, representing a response rate of 89.8 per cent against the planned sample of 440, exceeding the generally accepted minimum of 70 per cent for survey-based quantitative research (Saunders et al., 2019).

Common Method Bias

Because all three constructs were measured from a single respondent using the same instrument at one point in time, Harman's single-factor test was conducted by loading all 15 items into an unrotated principal axis factor analysis in SPSS. The single largest unrotated factor accounted for 68.2 percent of total variance, substantially above the conventional 50 per cent caution threshold, indicating that common method variance is a plausible and non-trivial contributor to the observed relationships, most notably the digital capability-entrepreneurial skills association reported later ($r = .864$). Harman's single-factor test can indicate the presence of a dominant shared factor but cannot itself partition observed covariance into method-related and substantive components (Podsakoff et al., 2012). Accordingly, the elevated value obtained here is treated as an explicit limitation on interpretation rather than a technicality to be explained away. In particular, the observed covariance among the constructs may reflect substantive relationships, common method variance, or a combination of both; the present design cannot fully adjudicate among these possibilities.

The strength and statistical significance of the regression and mediation results are therefore interpreted with appropriate caution and are not treated as evidence that common method bias is absent. Procedural safeguards recommended by Podsakoff, MacKenzie, and Podsakoff (2012), including respondent anonymity, unambiguous item wording, temporal and psychological separation of predictor, mediator, and outcome item blocks in the questionnaire, and assurance that there were no right or wrong answers, were applied at the design stage to limit inflation from method effects; because these are procedural rather than statistical controls, they reduce rather than eliminate the risk. This constraint is carried forward explicitly into the interpretation of the digital capability-entrepreneurial skills relationship and into the study's limitations.

Measures

Digital capability, the independent variable, was adapted from the scale developed by Lu and Ramamurthy (2011), a 5-item, 5-point Likert-scaled instrument capturing the effective use of digital technologies to improve daily operations, coordination, and responsiveness to customer demand. Entrepreneurial skills, the mediating variable, was adapted from Man et al. (2002) entrepreneurial competencies framework, a 5-item, 5-point Likert-scaled instrument capturing opportunity recognition, calculated risk-taking, innovation, strategic decision-making, and adaptability. MSME performance, the dependent variable, was measured using a 5-item subjective, perception-based scale adapted from Dess and Robinson (1984), Venkatraman and Ramanujam (1987), Wiklund and Shepherd (2005), and Sakib et al. (2022), capturing sales growth, relative profitability, operational efficiency, customer base expansion, and overall performance against expectations. A pilot study of 20 MSME operators outside the main sample confirmed acceptable reliability (Cronbach's $\alpha \geq 0.70$) before full administration, consistent with Nunnally and Bernstein's (1994) recommended threshold.

Data Analysis

Descriptive, reliability, and preliminary diagnostic statistics were generated in IBM SPSS Statistics Version 27 using standard Descriptives, Frequencies, and Reliability Analysis procedures. The mediation hypothesis was tested using Hayes' PROCESS macro for SPSS (Version 4.2, Model 4), which estimates ordinary least squares regression path coefficients for the direct and indirect effects and derives a bootstrap confidence interval for the indirect effect, removing the need to assume a normal sampling distribution for the product of coefficients (Hayes, 2018; Preacher and Hayes, 2008). Bootstrapping was set at 5,000 resamples with 95 percent percentile confidence intervals; an interval that does not straddle zero is considered evidence of a statistically significant indirect effect.

Result

Respondents' Socio-Demographic Characteristics

Descriptive statistical analysis conducted in IBM SPSS Statistics Version 27 on the 395 valid respondents is summarised in Table 1. Male respondents constituted 65 percent of the sample. The age distribution displayed high maturity, with the largest group (33.6%) aged 48-57 years, and 69.2 percent of respondents were married. Educational credentials were notably high: 62.9 percent held a First Degree and a further 25 percent held a Masters or PhD. Business longevity was substantial, with 46.5 percent of enterprises having operated for 10 years or more.

Table 1

Respondents' Socio-Demographic Characteristics.

Variable	Category	Frequency (N = 395)	Percentage (%)
Gender	Male	250	65.0
	Female	145	35.0
Age (years)	18–27	29	7.3
	28–37	113	28.8
	38–47	120	30.3

Variable	Category	Frequency (N = 395)	Percentage (%)
Marital Status	48–57	133	33.6
	Single	106	27.0
	Married	274	69.2
	Divorced	15	3.8
Qualification	Diploma	48	12.1
	First Degree	248	62.9
	Masters/PhD	99	25.0
Years in Business	2–5 years	89	22.5
	6–9 years	123	31.0
	10 years and above	183	46.5

Source: Field Survey, 2026.

Preliminary Analysis and Reliability

The dataset was screened for missing values, outliers, and normality; no missing values were found across any of the 15 indicator items, and no case exceeded a standardised score of $|z| = 3$. Skewness and kurtosis for the three composite construct scores fell within Table 2's reported range, comfortably within the ± 2 threshold that George and Mallery (2010) identify as acceptable for regression-based analysis. Internal consistency reliability, assessed using Cronbach's alpha together with corrected item-total correlations, is also presented in Table 2. The alpha values obtained (0.946, 0.960, and 0.927 for digital capability, entrepreneurial skills, and MSME performance respectively) are well above the 0.70 minimum recommended by Nunnally & Bernstein (1994), but they are also high enough to raise the possibility of item redundancy: with only five items per five-point Likert scale, alphas in this range can reflect items that are worded too similarly rather than a uniformly well-differentiated set of indicators of the underlying construct. The corrected item-total correlations (0.686 to 0.936) provide evidence of internal consistency and do not identify any item that fails the conventional 0.30 threshold. At the same time, they do not by themselves rule out item redundancy or excessive conceptual overlap. The combination of very high alpha coefficients and high corrected item-total correlations for a small number of similarly worded items therefore warrants continued attention to potential overlap among indicators, which is relevant to interpreting both the common method bias diagnostics above and the discriminant validity assessment below.

Table 2

Descriptive Statistics, Normality, and Reliability of Study Constructs.

Construct	Mean	SD	Skewness	Kurtosis	Cronbach's Alpha
Digital Capability (DC)	3.16	1.106	0.301	1.754	0.946
Entrepreneurial Skills (ES)	3.07	1.107	0.185	1.804	0.960
MSME Performance	3.06	1.166	0.012	1.751	0.927

N = 395. Acceptable normality range: ± 2 (George & Mallery, 2010). Corrected item-total correlations ranged from 0.686 to 0.936, all exceeding the 0.30 minimum (Nunnally & Bernstein, 1994).

Correlation and Multicollinearity

A Pearson correlation matrix computed among the composite construct scores confirmed that digital capability, entrepreneurial skills, and MSME performance are all positively and significantly correlated at $p < 0.01$: digital capability with entrepreneurial skills ($r = 0.864$), digital capability with MSME performance ($r = 0.649$), and entrepreneurial skills with MSME performance ($r = 0.691$). Variance inflation factor diagnostics, computed because digital capability and entrepreneurial skills were entered simultaneously as predictors of performance, returned a VIF of 3.951 and tolerance of 0.253 for both predictors, below Hair, Black, Babin, and Anderson's (2019) recommended threshold of 5.0, confirming that multicollinearity does not distort the regression estimates. However, the absence of a conventional multicollinearity problem does not, by itself, establish that digital capability and entrepreneurial skills are empirically distinct constructs: VIF and tolerance diagnose redundancy among predictors within a single regression equation, whereas the $r = .864$ correlation raises a separate, prior question of discriminant validity between the two measures. The heterotrait-monotrait ratio of correlations (HTMT; Henseler, Ringle, & Sarstedt, 2015) is one established way of examining this question, but it was developed specifically for, and is computed within, variance-based structural equation modelling (typically PLS-SEM, using software such as SmartPLS or WarpPLS, or R packages such as semTools); it presupposes a formally estimated reflective measurement model and is not a statistic produced by SPSS Statistics, which was used throughout this study for composite-score regression and PROCESS-macro mediation analysis. Introducing HTMT would therefore require re-estimating the entire model in a different analytical framework (PLS-SEM) that is not otherwise used anywhere in this study, rather than a proportionate addition to it. To address the underlying concern in a way that is consistent with the study's SPSS-based, composite-score design, the $r = .864$ correlation was instead tested directly against the value of a perfect ($r = 1.0$) relationship using a Fisher r -to- z transformation. This produced a 95 percent confidence interval of [.837, .887] around the observed correlation ($z = 1.309$, $SE = 0.051$, $n = 395$), which excludes 1.0. This provides supplementary statistical evidence that the two composite scores are not statistically indistinguishable. However, the Fisher r -to- z test does not constitute a measurement-level assessment of discriminant validity. A preferred approach is the heterotrait-monotrait ratio of correlations (HTMT; Henseler, Ringle, Sarstedt, 2015), computed from item-level data and preferably accompanied by a confidence interval. Because the present analysis relied exclusively on composite scores within SPSS and PROCESS, a full HTMT assessment was not performed and remains a methodological limitation. The high observed correlation ($r = .864$) therefore continues to warrant caution: discriminant validity cannot be treated as established, and the a -path and c' -path coefficients in Table 3 should be interpreted with this caveat alongside the common method bias limitation.

Mediation Analysis (Hayes PROCESS Macro, Model 4)

Hypotheses were tested using PROCESS Model 4, with digital capability specified as the independent variable (X), entrepreneurial skills as the mediator (M), and MSME performance as the dependent variable (Y). PROCESS Model 4 estimates three regression equations: entrepreneurial skills regressed on digital capability (path a), MSME performance regressed on digital capability and entrepreneurial skills simultaneously (paths b and c'), and MSME performance regressed on digital capability alone (path c , the total effect). All coefficients are unstandardised. The results are presented in Table 3.

Table 3*PROCESS Model 4 Path Coefficients and Mediation Test.*

Hyp	Path	Coeff.	SE	t	p	95% CI	Decision
H2	Digital Capability → Entrepreneurial Skills	0.865	0.025	34.055	.001	[0.815, 0.915]	Supported
H1	Digital Capability → Performance	0.215	0.076	2.833	.005	[0.066, 0.363]	Supported
H3	Entrepreneurial Skills → Performance	0.543	0.076	7.177	.001	[0.394, 0.692]	Supported
—	Digital Capability → Performance (c, total)	0.684	0.040	16.906	.001	[0.605, 0.764]	—
H4	Indirect effect ($a \times b$)	0.470	0.075 *	—	—	[0.315, 0.611]	Partial mediation

* *BootSE. Bootstrapping: 5,000 resamples; 95% bootstrap CI excluding zero indicates a significant indirect effect (Hayes, 2018; Preacher and Hayes, 2008).*

All four hypothesised relationships received statistical support. Digital capability alone was associated with 42.1 percent of the variance in MSME performance in the total-effect model ($R^2 = 0.421$, $F(1, 393) = 285.822$, $p .001$). Once entrepreneurial skills was introduced, digital capability and entrepreneurial skills jointly explained 48.8 percent of the variance in performance ($R^2 = 0.488$, $F(2, 392) = 187.028$, $p .001$), and the direct effect of digital capability fell from $c = 0.684$ to $c' = 0.215$, the pattern that a statistical mediation effect produces under PROCESS Model 4. Digital capability alone was associated with 74.7 percent of the variance in entrepreneurial skills ($R^2 = 0.747$, $F(1, 393) = 1159.718$, $p .001$), the strongest relationship in the model. The bootstrap confidence interval for the indirect effect [0.315, 0.611] excludes zero, confirming a statistically significant indirect effect (indirect effect = 0.470, BootSE = 0.075). Because the direct effect c' (0.215) remained significant alongside the indirect effect, the mediation is classified as partial rather than full (Preacher Hayes, 2008), and the proportion of the total effect carried through the indirect path ($0.470 / 0.684$) is 68.6 percent, meaning more than two-thirds of digital capability's total statistical association with MSME performance is transmitted through the entrepreneurial skills it builds. This finding is reported as an indirect statistical association established through regression-based mediation analysis of cross-sectional data; it is evidence consistent with the hypothesised sequence, but the cross-sectional design does not establish the temporal precedence required to treat digital capability, entrepreneurial skills, and performance as a confirmed causal chain, and the result should not be read as definitive causal evidence of that sequence.

Discussion

A parsimonious mediation model was proposed to understand MSME performance in Bauchi State via the predictive role of digital capability and the intervening role of entrepreneurial skills. We hypothesised a direct and an indirect relationship, underpinned by Dynamic Capabilities Theory and Human Capital Theory. For H1, hypothesising a direct link between digital capability and MSME performance, the finding was supported: digital capability was significantly associated with performance ($c' = 0.215$, $p = .005$) even after entrepreneurial skills was controlled for. This pattern is consistent with the interpretation that MSME owner-managers who report greater use of digital tools for operations, coordination, and customer reach

also report higher performance, although the cross-sectional design does not establish that digital tools produce these performance differences through operational efficiency. This aligns with Kim and Jin (2024) and with Prakasa and Jumaní (2024), extending this literature into a Nigerian MSME setting.

The finding for H2, that digital capability is exceptionally strongly associated with entrepreneurial skills ($\beta = 0.865$, $p < .001$, accounting for nearly three-quarters of the variance in entrepreneurial skills), is the strongest association documented in this study. Given its magnitude and the elevated Harman's single-factor value reported earlier, this association is interpreted cautiously: the observed covariance may reflect a substantive relationship, common method variance, or both, and the present design cannot fully separate these sources. Owner-managers who are digitally capable also report markedly stronger opportunity recognition, risk-taking, innovativeness, strategic decision-making, and adaptability. This is consistent with Sariwulan et al. (2020), who establish that digital literacy, economic literacy, and entrepreneurial skills are jointly foundational to entrepreneurial performance, and with Okonye et al. (2024), who confirm that entrepreneurial competencies with a strong technical and digital component significantly shape MSME performance in south-western Nigeria. The strength of the present relationship exceeds these earlier findings; a plausible substantive interpretation is that digital fluency is strongly associated with entrepreneurial skill among Bauchi State's MSME operators, though, as noted above, the unusually high shared variance between the two constructs means this interpretation should be read alongside the common-method-bias caveat rather than as a settled conclusion.

The finding for H3 confirms that entrepreneurial skills are significantly associated with MSME performance ($\beta = 0.543$, $p < .001$), more than double the size of the direct digital capability association, reinforcing Sariwulan et al. (2020) and Okonye et al. (2024) and indicating that, within this model, entrepreneurial skills show a stronger statistical association with performance. Owner-managers who identify opportunities ahead of competitors, take calculated risks, innovate, make strategic long-term decisions, and adapt quickly to a changing business environment record correspondingly higher sales growth, profitability, operational efficiency, and customer base expansion.

The significant partial mediation confirmed under H4 (indirect effect = 0.470, BootCI [0.315, 0.611], carrying 68.6 percent of the total effect) is consistent with the theoretical integration of Dynamic Capabilities Theory and Human Capital Theory: the statistical pattern is one in which digital capability's association with MSME performance runs mainly through entrepreneurial skills, and only secondarily through a direct operational channel. This is consistent with Hutama et al. (2023) and Prakasa and Jumaní (2024), who find comparable intervening mechanisms linking digital capability to SME performance. As with the results reported above, this should be read as evidence of indirect statistical association rather than as definitive causal evidence of the underlying process: the cross-sectional, self-reported design does not permit strong causal conclusions about the sequence through which digital capability is hypothesised to be associated with entrepreneurial skills and, in turn, with performance, and an equally plausible reverse or reciprocal sequence (for example, more entrepreneurially skilled owner-managers adopting and using digital tools more effectively) cannot be ruled out by this design. With that caveat, the practical implication suggested by the pattern is that digital capability appears to matter for MSME performance substantially through the entrepreneurial behaviour associated with it, opportunity recognition, risk-taking, innovation, strategic decision-making, and adaptability, rather than through the direct operational channel alone.

Implications of Findings

The study makes a modest theoretical contribution by integrating Dynamic Capabilities Theory with Human Capital Theory, suggesting that firm-level digital competency shows its largest statistical association with MSME performance through the individual-level entrepreneurial skills with which it is linked, rather than through operational efficiency gains alone; this pattern is reported as a statistical association observed in cross-sectional data rather than a demonstrated causal mechanism. Practically, the findings tentatively imply that MSME support programmes confined to digital tools training, without a parallel entrepreneurial skills component, may realise only a fraction, roughly one-third on the pattern observed here, of digital capability's potential association with performance. On this basis, MSME support programmes in Bauchi State may benefit from bundling digital skills training with entrepreneurial skills development, opportunity recognition, risk assessment, strategic decision-making, and adaptability training, rather than delivering digital tools training in isolation, and financial institutions and business development service providers could consider designing MSME financing and advisory packages that combine digital infrastructure support with entrepreneurship mentorship, reflecting the complementary relationship between the two capabilities observed in this study. These implications should be treated as provisional pending confirmation through the longitudinal and objectively measured designs recommended below.

Limitations and Suggestions for Further Studies

This study makes a modest contribution to understanding MSME performance, though not without limitations. The cross-sectional design prevents causal inference and cannot capture the temporal sequence through which digital capability is hypothesised to be associated with entrepreneurial skills and, in turn, MSME performance over time; an equally plausible reverse or reciprocal sequence cannot be ruled out. Self-reported questionnaire data on the predictor, mediator, and outcome constructs from the same respondent at the same point in time raises the possibility of common method bias; Harman's single-factor test returned a value of 68.2 per cent, above the conventional 50 per cent caution threshold, and while procedural safeguards were applied during questionnaire design, these safeguards reduce rather than eliminate the risk. The strength and consistency of the regression results are consistent with either a substantive relationship, common method variance, or a combination of both, and both explanations remain open given the present design. In addition, the absence of a formal measurement-level assessment of discriminant validity (such as HTMT) is treated as a substantive methodological limitation: given the high correlation between digital capability and entrepreneurial skills ($r = .864$), discriminant validity cannot be treated as established, and the mediation path coefficients should be interpreted with this caveat. The study is geographically limited to Bauchi State, constraining generalisability to other Nigerian states or MSME populations with different sectoral compositions. MSME performance was also measured subjectively, through owner-manager perceptions of sales growth, profitability, operational efficiency, customer base expansion, and overall performance against expectations, rather than through objective financial or operational records; this is a substantive limitation rather than a minor caveat. Owner-managers' perceptions of their own firm's performance can be shaped by optimism, social desirability, recall, or the same digital and entrepreneurial engagement that the study treats as predictors, and prior research cautions that self-reported performance measures, while commonly used and moderately correlated with objective indicators in MSME research where audited financial records are often unavailable, are not equivalent to objectively measured financial or operational performance and can diverge from it in systematic ways. The performance findings reported here should therefore be read as findings about owner-managers' perceptions of performance, which are informative for MSME support policy and business development services but

should not be presented or interpreted as equivalent to verified financial outcomes. The study also does not account for potential moderating effects of MSME sector, firm age, size, or owner-manager educational attainment. Future researchers might extend this model through a longitudinal panel design, incorporate objective performance indicators (for example, verifiable sales or tax records) alongside self-reported measures to assess convergence between the two, test moderating variables such as MSME sector, firm size, and firm age using PROCESS Model 7 or Model 14 for moderated mediation, and replicate the model in other Nigerian states and MSME sub-sectors to establish how far the mediation pathway observed in this study generalises.

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