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Digital Transformation, Organisational Agility and Sustainable Performance of Manufacturing SMEs in North Central Nigeria

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Abstract: Digital transformation is increasingly important to the ability of manufacturing small and medium enterprises (SMEs) to respond to changing business conditions and sustain organisational performance. However, the relationship between digital transformation and sustainable performance may depend on the organisational capabilities through which digital resources are utilised. This study examined the relationship between digital transformation and sustainable performance among manufacturing SMEs in North Central Nigeria, with organisational agility examined as a mediating mechanism. The study was anchored on Dynamic Capabilities Theory and Absorptive Capacity Theory. A quantitative, cross-sectional survey design was adopted. From a target population of 161,313 manufacturing SMEs, a sample of 757 firms was determined, and 547 valid responses were used for analysis. Data were collected using a structured questionnaire and analysed using descriptive statistics and Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings showed significant positive relationships between digital transformation and organisational agility (β = 0.404), digital transformation and sustainable performance (β = 0.276), and organisational agility and sustainable performance (β = 0.564). Organisational agility also demonstrated a significant positive indirect relationship between digital transformation and sustainable performance (β = 0.228), indicating that organisational agility partially explains the relationship between digital transformation and sustainable performance. The findings highlight the importance of organisational agility in understanding how manufacturing SMEs translate digital capabilities into sustainable performance outcomes. The study contributes empirical evidence from manufacturing SMEs in North Central Nigeria and extends understanding of the organisational mechanisms through which digital transformation is associated with sustainable performance.

Keywords: *Digital Transformation, Organisational Agility, Sustainable Performance, Manufacturing SMEs, North Central Nigeria, PLS-SEM.*

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I. INTRODUCTION

Small and medium enterprises (SMEs) play an important role in employment, production, entrepreneurship and economic development. In Nigeria, manufacturing SMEs operate in an environment characterised by infrastructure challenges, energy constraints, limited access to appropriate technologies and pressure on available resources. These conditions can make it difficult for firms to improve productivity while responding to changing market demands and maintaining sustainable performance. For manufacturing SMEs, the ability to adapt to these conditions and make effective use of available resources is therefore increasingly important.

Digital transformation (DT) has changed the way firms manage information, organise activities, communicate with customers and make decisions. It extends beyond the adoption of individual technologies to the integration of digital technologies into business processes and organisational activities (Fitzgerald et al., 2014; Verhoef et al., 2021). For manufacturing SMEs, such integration can improve access to information, support decision-making, enhance coordination and create opportunities to improve business processes. However, adopting digital technologies does not automatically lead to improved organisational outcomes. Firms also need the capacity to use digital resources effectively and respond to changes in their operating environment.

Organisational agility (OA) may help explain how firms translate digital capabilities into improved performance. Organisational agility refers to the ability of a firm to recognise changes in its environment and respond to them in a timely and appropriate manner. Digital technologies can provide firms with faster access to

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information and improve communication and coordination, but these benefits are more likely to be realised when firms can act on the information available to them. This perspective is consistent with Dynamic Capabilities Theory, which emphasises the ability of firms to sense changes, seize opportunities and reconfigure resources in changing environments (Teece et al., 1997; Teece, 2007; Teece et al., 2016).

Sustainable performance provides a broader basis for assessing organisational outcomes because it considers the ability of firms to achieve economic objectives while also addressing environmental and social considerations. For manufacturing SMEs, sustainable performance is particularly relevant because operational decisions can affect resource use, environmental conditions, employees, customers and surrounding communities. Firms therefore need to balance economic performance with environmental and social responsibilities. Examining sustainable performance provides a more comprehensive basis for understanding the organisational outcomes associated with digital transformation.

Although digital transformation and organisational agility have received increasing attention in the literature, there remains limited empirical evidence on how organisational agility helps explain the relationship between digital transformation and sustainable performance among manufacturing SMEs in North Central Nigeria. In particular, the extent to which digital transformation is associated with sustainable performance directly, and indirectly through organisational agility, requires further empirical examination. This is important because the value of digital transformation may depend not only on the technologies firms adopt but also on their ability to respond effectively to changes in their operating environment.

Against this background, this study examines the relationship between digital transformation and sustainable performance among manufacturing SMEs in North Central Nigeria, with organisational agility examined as a mediating mechanism. Specifically, the study examines the relationships between digital transformation and sustainable performance, digital transformation and organisational agility, and organisational agility and sustainable performance. It further examines the mediating role of organisational agility in the relationship between digital transformation and sustainable performance.

II. LITERATURE REVIEW

➢ *Conceptual Review*

- *Sustainable Performance*

Sustainable performance refers to an organisation's ability to achieve its economic objectives while also considering its environmental and social responsibilities. It goes beyond financial performance by recognising that the long-term success of an organisation depends on how well it balances economic, environmental and social outcomes. Elkington (1997) explains this broader perspective through the Triple Bottom Line, which emphasises people, planet and profit. Schaltegger and Wagner (2011) similarly emphasise the incorporation of sustainability into organisational strategies and business activities.

The economic dimension concerns an organisation's ability to remain productive, profitable, competitive and capable of sustaining its operations over time. Porter and van der Linde (1995) argue that addressing environmental challenges can encourage firms to improve production processes and use resources more efficiently. Such improvements may reduce waste and costs while creating opportunities for innovation and competitiveness. Nidumolu et al. (2009) similarly observe that sustainability can encourage organisations to identify new opportunities, improve efficiency and develop new products and processes.

The environmental dimension concerns the extent to which organisations reduce the environmental consequences of their activities. This includes efficient resource use, waste reduction, reduced emissions and production practices that minimise environmental harm. This dimension is particularly relevant to manufacturing SMEs because their operations may involve significant use of energy, raw materials and other resources.

The social dimension concerns an organisation's responsibilities towards employees, customers, communities and other stakeholders. It includes employee welfare, responsible business practices, stakeholder relationships and the contribution of business activities to society.

In this study, sustainable performance is therefore considered a multidimensional construct comprising economic, environmental and social dimensions. This approach recognises that sustainable performance among manufacturing SMEs cannot be adequately represented by financial outcomes alone.

- *Digital Transformation*

Digital transformation refers to the integration and application of digital technologies to improve business processes, organisational activities and the ways in which firms create and deliver value. Westerman et al. (2014) explain that digital transformation extends beyond the adoption of new technologies to include changes in organisational processes, structures and culture. Kane et al. (2015) similarly argue that successful digital transformation requires organisations to align digital technologies with their strategies and objectives. Fitzgerald et al. (2014) further emphasised the importance of organisational leadership in supporting digital initiatives.

Digital transformation can improve operational efficiency, access to information, customer engagement and organisational decision-making. Through digital technologies, firms can automate routine activities, improve communication, analyse information more effectively and respond to changes in customer needs and market conditions.

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However, digital transformation is not limited to the acquisition of technological tools. It also involves changes in organisational processes, capabilities and approaches to value creation. For SMEs, these changes can create opportunities to improve productivity, expand market reach and strengthen competitiveness.

The effective implementation of digital transformation also depends on organisational factors. Leadership commitment, employee capabilities, organisational culture and willingness to adapt can influence how successfully digital technologies are integrated into business activities. Firms therefore require both appropriate technological resources and the organisational capacity to use them effectively.

For manufacturing SMEs in North Central Nigeria, digital transformation may provide opportunities to improve processes, access information, strengthen customer relationships and respond to changing operating conditions. Accordingly, digital transformation is considered in this study as an organisational capability with potential implications for sustainable performance.

- *Organisational Agility*

Organisational agility refers to an organisation's ability to recognise and respond effectively to changes in its business environment. It involves the capacity to adjust strategies, processes and resources in response to changing customer needs, market conditions, technological developments and competitive pressures. Doz and Kosonen (2008) associate organisational agility with strategic sensitivity, collective commitment and resource fluidity.

Agility is particularly important for firms operating in dynamic environments. Agile organisations can modify their operations, reallocate resources and adjust strategies when confronted with emerging challenges or opportunities. Such capabilities can support innovation, operational responsiveness and more effective use of available resources.

For manufacturing SMEs, these capabilities are relevant because changes in technology, customer preferences, competition and operating conditions can directly affect production and performance. In the context of this study, organisational agility represents the ability of manufacturing SMEs to respond to changes through timely decision-making, flexible processes and effective resource reconfiguration.

- *Conceptual Framework*

The conceptual framework brings together the relationships examined in this study. It proposes that digital transformation (DT) is related to sustainable performance (SP) and that organisational agility (OA) provides a pathway through which digital transformation may be associated with sustainable performance. The framework is presented in Figure 1.

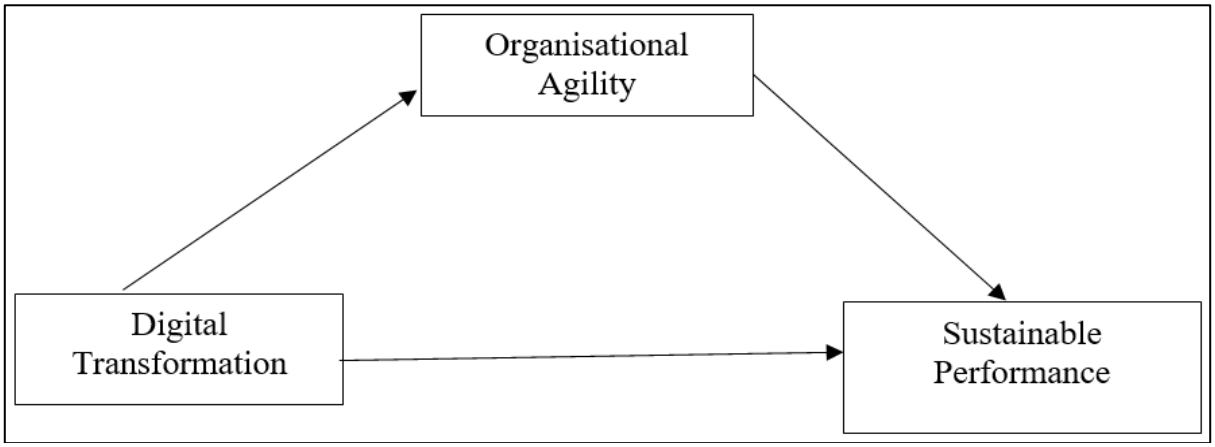


Fig 1 Conceptual Framework of Digital Transformation, Organisational Agility and Sustainable Performance of Manufacturing SMEs
Source: Researcher's conceptualisation (2026).

➢ *Digital Transformation and Sustainable Performance*

Digital transformation has become increasingly important to how firms organise their activities, manage information, improve processes and respond to changing business conditions. Through the use of digital technologies, firms can improve access to information, support decision-making, coordinate activities and respond more effectively to customer and market requirements. For manufacturing SMEs, these capabilities may help improve operational performance while supporting longer-term economic, environmental and social outcomes.

Digital technologies can contribute to economic performance by improving operational efficiency, reducing avoidable costs and enabling firms to respond more quickly to market changes. They may also support environmental performance by helping firms monitor production activities, identify waste and use materials, energy and other resources more efficiently. In addition, improved communication and access to information can support social outcomes involving employees, customers and other stakeholders. Digital transformation may therefore provide firms with opportunities to pursue performance outcomes that extend beyond short-term financial considerations.

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However, the adoption of digital technologies alone does not guarantee improved sustainable performance. The value derived from digital transformation depends partly on how effectively firms integrate and use digital resources within their organisational activities. A firm may invest in digital technologies without achieving meaningful performance improvements if it lacks the organisational capacity to apply them effectively. From the perspective of Dynamic Capabilities Theory, digital resources become more valuable when firms are able to deploy, adapt and reconfigure them in response to changing environmental conditions (Teece et al., 1997; Teece, 2007; Teece et al., 2016).

For manufacturing SMEs in North Central Nigeria, the ability to use digital technologies effectively may therefore be associated with improved sustainable performance. The study consequently examines whether a significant relationship exists between digital transformation and sustainable performance.

- H_o1: There is no significant relationship between digital transformation and sustainable performance among manufacturing SMEs in North Central Nigeria.

➢ *Digital Transformation and Organisational Agility*

Digital transformation may strengthen organisational agility by improving access to information, communication, decision-making and coordination. Digital technologies can provide firms with timely information about customer requirements, market conditions and competitive pressures, enabling them to recognise changes and adjust organisational activities more quickly.

Wamba et al. (2017) emphasise the role of digital and data-driven capabilities in helping organisations derive value from information and respond to changing conditions. Similarly, Doz and Kosonen (2008) describe organisational agility in terms of strategic sensitivity, collective commitment and resource fluidity. These perspectives suggest that digital transformation can provide resources and capabilities that support firms' ability to recognise changes, make timely decisions and adjust their operations.

However, the availability of digital technologies does not automatically result in organisational agility. Organisational processes, employee capabilities and the willingness to adapt can influence how effectively firms translate digital resources into organisational responses. Hanelt et al. (2021) similarly emphasise that digital transformation involves broader organisational changes rather than technology adoption alone.

For manufacturing SMEs in North Central Nigeria, the ability to use digital technologies to access information, support decision-making and coordinate activities may therefore be associated with greater organisational agility. The study consequently examines whether a significant relationship exists between digital transformation and organisational agility.

- H_o2: There is no significant relationship between digital transformation and organisational agility among manufacturing SMEs in North Central Nigeria.

➢ *Organisational Agility and Sustainable Performance*

Organisational agility may help firms maintain performance in changing environments by enabling timely adjustments to processes, resources and strategies. An agile organisation can respond to changing customer requirements, market conditions and technological developments without being constrained by rigid organisational processes. The ability to respond quickly may therefore be important for firms operating in uncertain and competitive environments.

For manufacturing SMEs, this capability may be particularly important because limited resources can make delays in decision-making and resource allocation costly. Organisational agility can help firms recognise changes, adjust production and operational processes, and redirect resources towards emerging opportunities. These responses may support improvements in performance while helping firms adapt to changing economic, environmental and social requirements.

Troise et al. (2022) provide evidence of a positive association between organisational agility and financial, product innovation and process innovation outcomes among SMEs. Their findings suggest that organisational agility can serve as an organisational capability through which firms respond to changes in their environment and improve performance outcomes.

From the perspective of Dynamic Capabilities Theory, organisational agility reflects a firm's capacity to adjust and reconfigure its resources in response to changing conditions. Such capability may support sustainable performance by enabling firms to respond to economic requirements while also considering environmental and social considerations.

For manufacturing SMEs in North Central Nigeria, organisational agility may therefore be associated with their ability to sustain performance in changing business conditions. The study consequently examines whether a significant relationship exists between organisational agility and sustainable performance.

- H_o3: There is no significant relationship between organisational agility and sustainable performance among manufacturing SMEs in North Central Nigeria.

➢ *Mediating Role of Organisational Agility*

The relationships discussed in the preceding sections suggest that digital transformation may be associated with sustainable performance through organisational agility. Digital technologies can provide firms with timely information, improve communication and support coordination. However, the extent to which these digital resources are translated into organisational outcomes may depend on the firm's ability to recognise changes, respond to them and adjust its resources and activities accordingly.

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Dynamic Capabilities Theory provides a useful explanation of this mechanism. Teece et al. (1997) argue that organisational outcomes depend not only on the resources available to a firm but also on the organisational processes through which those resources are integrated and reconfigured. Teece (2007) further explains dynamic capabilities in terms of sensing opportunities and threats, seizing opportunities and reconfiguring resources to respond to changing environments. Organisational agility reflects these adaptive capabilities and may therefore provide an important link between digital transformation and sustainable performance.

Absorptive Capacity Theory provides a complementary perspective by emphasising how firms acquire, assimilate, transform and exploit knowledge. Cohen and Levinthal (1990) highlight the importance of recognising and applying external knowledge, while Zahra and George (2002) distinguish between potential and realised absorptive capacity. Digital transformation can expand a firm's access to information and digital knowledge, but the value of these resources may depend on the firm's ability to use them effectively in responding to changes.

The mediating role of organisational agility is therefore theoretically plausible. Digital transformation may provide firms with technological resources and information, while organisational agility may help them translate these resources into timely organisational responses and resource adjustments that are associated with sustainable performance. In this sense, organisational agility may help explain how digital transformation is related to sustainable performance. Therefore:

- H_04: Organisational agility does not significantly mediate the relationship between digital transformation and sustainable performance among manufacturing SMEs in North Central Nigeria.

III. METHODOLOGY

➢ *Research Design*

The study adopted a quantitative research approach using a cross-sectional survey design. The design was appropriate because the study sought to examine the relationships among digital transformation, organisational agility and sustainable performance using data collected from manufacturing SMEs within a defined period.

The cross-sectional design enabled data to be collected from a relatively large number of manufacturing SMEs across North Central Nigeria and provided a basis for empirically examining the proposed relationships. However, because the data were collected at a single point in time, the findings are interpreted in terms of relationships and associations rather than causal effects.

➢ *Population and Sample*

- *Population*

The target population comprised manufacturing SMEs operating across the six states of North Central Nigeria and the Federal Capital Territory. The population consisted of 161,313 SMEs, comprising 147,646 small enterprises and 13,667 medium enterprises in the manufacturing sector. The distribution of the population across the study locations is presented in Table 1.

The population figures vary across the study locations, reflecting differences in the number of manufacturing SMEs operating within each location. This distribution provided the basis for determining the coverage of the study sample across the seven study locations.

Table 1 Population of SMEs in the Manufacturing Sector

S/N	North Central States	Population Size of Small Enterprises	Population Size of Medium Enterprises	Total
1	Benue State	18,420	2,280	20,700
2	Niger State	27,850	2,460	30,310
3	Kogi State	15,760	1,710	17,470
4	Plateau State	19,980	1,980	21,960
5	Federal Capital Territory	31,450	2,730	34,180
6	Kwara State	21,640	1,430	23,070
7	Nasarawa State	12,546	1,077	13,623
Total		147,646	13,667	161,313

Source: SMEDAN (2021).

- *Sample Size Determination*

The sample size was determined using the formula of Krejcie and Morgan (1970). Applied to the pooled population of 161,313 manufacturing SMEs, the formula returns a minimum of 384 owner-managers at a 95% confidence level and a 5% margin of error. Because small and medium manufacturing enterprises differ materially in resource endowment, formalisation and digital capacity, the formula was applied separately to each enterprise-size stratum so that both groups would be adequately represented. The resulting allocation is equal in size across the two groups rather than proportional to their population shares (about 91.5% small and 8.5% medium enterprises), and the analysis was not weighted to the population composition. This yielded 383 owner-managers of small enterprises and 374 of medium enterprises, a total of 757. The formula is:

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$S = \chi^2 NP(1 - P) / [e^2(N - 1) + \chi^2 P(1 - P)]$

Where:

$\chi^2 = 3.841$ (chi-square value for 1 degree of freedom at the 95% confidence level)

N = population size

P = assumed population proportion, usually 0.5 for maximum sample size

e = 0.05 (desired margin of error, 5%)

- *Sample Size for Small Manufacturing Enterprises*

$S = (3.841 \times 147{,}646 \times 0.5 \times 0.5) / (0.05^2 \times 147{,}645 + 3.841 \times 0.5 \times 0.5)$

$= 141{,}777.07 / (369.11 + 0.96)$

$= 141{,}777.07 / 370.07$

≈ 383.11, rounded to 383

- *Sample Size for Medium Manufacturing Enterprises*

$S = (3.841 \times 13{,}667 \times 0.5 \times 0.5) / (0.05^2 \times 13{,}666 + 3.841 \times 0.5 \times 0.5)$

$= 13{,}123.74 / (34.17 + 0.96)$

$= 13{,}123.74 / 35.13$

≈ 373.63, rounded to 374

- *Statistical Power for PLS-SEM*

The Krejcie and Morgan formula establishes precision for population estimation but not statistical power for the structural model, so a separate power assessment was conducted. Using the inverse square root method (Kock & Hadaya, 2018), the minimum sample required to detect a path coefficient of 0.197, the smallest effect of substantive interest in this model, at 5% significance with 80% power is n = 160. Using G*Power 3.1 (Faul et al., 2009) for a linear multiple regression fixed-model R^2 deviation from zero, with three predictors of the dependent construct, alpha = .05, power = .80 and a medium effect size of $f^2 = 0.15$, the minimum required sample is n = 77. The 547 valid responses used in the analysis (338 small and 209 medium enterprises) exceed both thresholds by a wide margin, and each enterprise-size group taken separately also exceeds them, so the model is adequately powered for the direct and indirect tests.

➢ *Sampling Technique*

The choice of sampling technique influences the generalisability of research findings and the extent to which conclusions drawn from the sample can be extrapolated to the broader population. Given the geographical dispersion of manufacturing SMEs across North Central Nigeria, the heterogeneity of manufacturing sub-sectors and the requirement for representative coverage of both enterprise sizes, this study employed a stratified probability sampling design.

The seven administrative units of North Central Nigeria, namely Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States and the Federal Capital Territory (FCT), Abuja, were treated as strata rather than as clusters, because every unit enters the sample and none is sampled out. Stratification was used because the units differ in industrial composition, infrastructure endowment and policy environment, all of which plausibly affect digital adoption and organisational performance, and stratifying on them reduces sampling variance relative to simple random selection across the region.

The sample was also allocated by enterprise size, consistent with the separate sample-size determination in Section 3.2.2, giving 383 small enterprises and 374 medium enterprises, a total of 757.

➢ *Data Collection*

Primary data were collected using a structured questionnaire designed to obtain information on digital transformation, organisational agility and sustainable performance.

The questionnaire items were measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The questionnaires were administered to selected manufacturing SMEs across the seven study locations.

Digital transformation was measured using six indicators, while organisational agility was measured using seven indicators. Sustainable performance was measured through economic, environmental and social dimensions, each comprising four indicators. The questionnaire therefore contained 25 measurement indicators for the three principal constructs.

➢ *Data Analysis*

This study employed the Statistical Package for the Social Sciences (SPSS) to conduct descriptive statistics. Partial Least Squares Structural Equation Modelling (PLS-SEM) using SmartPLS 4.1.1.8 was used for model evaluation and path estimation. The choice of PLS-SEM was driven by the exploratory nature of the study and the complexity of the proposed model, which includes a mediating variable (Hair et al., 2011). Sustainable performance, whose indicators are drawn from the economic, environmental and social dimensions, was specified as a single construct in the estimated model.

In addition, PLS-SEM assumes that data need not be normally distributed, relationships among constructs are linear, models are theoretically grounded with specified causal directions, indicators are either reflective or formative, multicollinearity is minimal, sample sizes are adequate for estimation, and the primary objective is to

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maximise explained variance for predictive purposes (Hair et al., 2021). In PLS-SEM, the model is divided into two main components: the measurement model and the structural model. The measurement model specifies the relationship between latent constructs and their observed indicators, assessing reliability and validity through indicator reliability, internal consistency reliability (Cronbach's alpha and composite reliability), convergent validity (average variance extracted, AVE) and discriminant validity (heterotrait–monotrait ratio, HTMT; Henseler et al., 2015). The structural model represents the relationships among latent constructs, testing the proposed hypotheses and evaluating path coefficients, the coefficient of determination (R^2), and the significance of relationships using bootstrapping techniques.

➢ *Measurement of Variables*

Digital transformation was measured using six items, while organisational agility was measured using seven items. Sustainable performance was measured through three dimensions: economic, environmental and social sustainable performance, each comprising four items. All measurement items were assessed using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Internal consistency was assessed using Cronbach's alpha and composite reliability. Convergent validity was considered using indicator loadings and AVE, while discriminant validity was assessed using the HTMT ratio (Henseler et al., 2015).

Given the multidimensional nature of sustainable performance, its twelve indicators were drawn equally from the economic, environmental and social dimensions and were specified on a single construct in the estimated model. The implications of this specification for the measurement results are considered in Section 4.1.3 and in the limitations of the study.

➢ *Ethical Considerations*

Participation in the study was voluntary. Respondents were informed of the purpose of the study and the information collected was treated confidentially. The questionnaire did not require respondents to provide information that would directly identify them in the reporting of the findings. Data were used solely for the stated academic research purpose.

IV. RESULTS AND DISCUSSION OF FINDINGS

A. Results

➢ *Distribution of Valid Questionnaires*

Of the 757 questionnaires distributed, 614 were returned. After screening, 67 questionnaires were excluded because they were incomplete. A total of 547 questionnaires were therefore considered valid for analysis, representing a response rate of 72.3%.

The valid responses comprised 338 small enterprises and 209 medium enterprises across the seven study locations.

➢ *Descriptive Statistics*

The descriptive statistics for the three study constructs are presented in Table 2.

Table 2 Descriptive Statistics of Study Variables

Construct	Mean	Standard Deviation
Digital Transformation	4.043	0.444
Organisational Agility	4.178	0.365
Sustainable Performance	4.147	0.324

Source: Field Survey, 2026.

The mean scores indicate relatively high reported levels of digital transformation, organisational agility and sustainable performance among the sampled manufacturing SMEs. Organisational agility recorded the highest mean score (4.178), followed by sustainable performance (4.147) and digital transformation (4.043).

➢ *Measurement Model Assessment*

Table 3 Reliability and Convergent Validity Assessment

Construct	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Digital Transformation	6	0.615–0.696	0.735	0.821	0.433
Organisational Agility	7	0.529–0.706	0.740	0.818	0.394
Sustainable Performance	12	0.150–0.716	0.602	0.795	0.269

Source: Field Survey, 2026.

The measurement model results indicate acceptable internal consistency for Digital Transformation and Organisational Agility based on Cronbach's alpha and composite reliability. However, the AVE values are below the recommended 0.50 threshold (Hair et al., 2021), indicating that convergent validity is not established for any of the three constructs. Sustainable Performance is the weakest construct: its Cronbach's alpha (0.602) is marginal, its AVE (0.269) is far below the threshold and some indicator loadings are very low (as low as 0.150).

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This pattern is consistent with treating three conceptually distinct dimensions as a single reflective construct, and the composite reliability of 0.795 is not sufficient on its own to establish construct validity. The estimated measurement model, showing the indicator loading ranges, is presented in Figure 2.

➢ *Discriminant Validity*

Table 4 Heterotrait–Monotrait (HTMT) Ratio

Construct	DT	OA	SP
Digital Transformation	—	0.539	0.677
Organisational Agility	0.539	—	0.861
Sustainable Performance	0.677	0.861	—

Source: Field Survey, 2026.

The HTMT values are below the 0.90 threshold (Henseler et al., 2015), indicating discriminant validity under the more lenient criterion. However, the HTMT value between Organisational Agility and Sustainable Performance (0.861) exceeds the stricter 0.85 threshold, so discriminant validity between these two constructs is marginal. Overall, the measurement assessment supports acceptable internal consistency for Digital Transformation and Organisational Agility. However, the convergent-validity results indicate that the multidimensional specification of Sustainable Performance must be taken into account when interpreting the measurement model.

➢ *Structural Model Assessment*

Table 5 Structural Model Results

Relationship	Beta (β)	T-Stat	P-Value	Result
DT → SP	0.276	7.06	<0.001	Significant
DT → OA	0.404	10.34	<0.001	Significant
OA → SP	0.564	15.30	<0.001	Significant
DT → OA → SP (Mediation)	0.228	8.08	<0.001	Partial Mediation

Source: Field Survey, 2026.

The structural model assessment reveals significant positive relationships among the study constructs. Digital Transformation has a positive and significant relationship with Sustainable Performance (β = 0.276, t = 7.06, p < 0.001). Digital Transformation also has a positive and significant relationship with Organisational Agility (β = 0.404, t = 10.34, p < 0.001), while Organisational Agility has a positive and significant relationship with Sustainable Performance (β = 0.564, t = 15.30, p < 0.001). The indirect relationship between Digital Transformation and Sustainable Performance through Organisational Agility is also significant (β = 0.228, t = 8.08, p < 0.001). Since the direct relationship between Digital Transformation and Sustainable Performance remains significant in the presence of Organisational Agility, the result indicates partial mediation. The estimated structural model, showing the path coefficients, R^2 values and indicator loading ranges, is presented in Figure 2. Because convergent validity is not established, the path coefficients should be read as indicative of association within the specified model rather than as precise estimates of effect size.

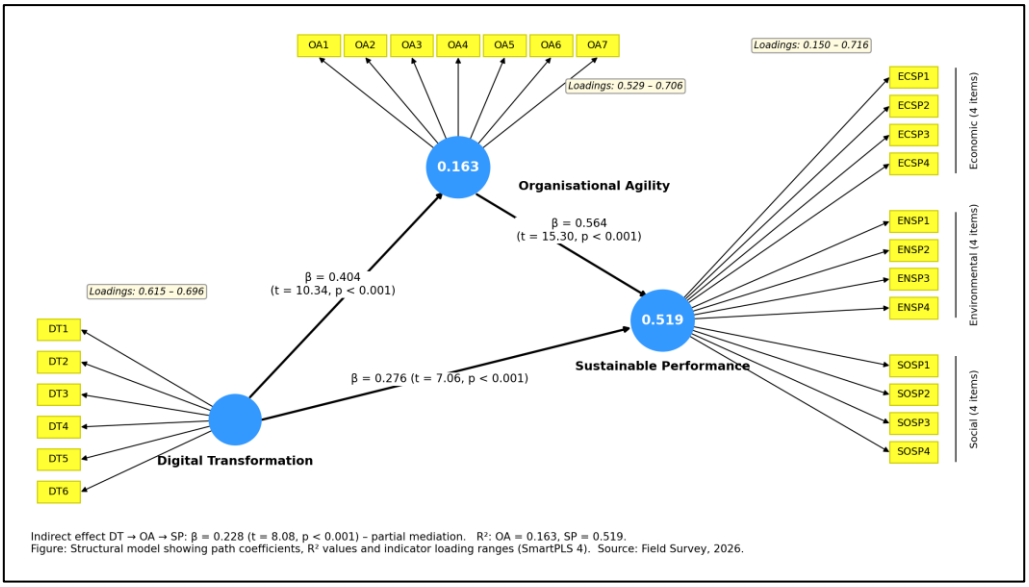


Fig 2 Structural Model Showing the Path Coefficients
Source: Field Survey, 2026 (SmartPLS 4 Output).

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➢ *Coefficient of Determination*

Table 6 Coefficient of Determination (R^2)

Endogenous Construct	R^2
Organisational Agility	0.163
Sustainable Performance	0.519

Source: Field Survey, 2026.

The model explains 16.3% of the variance in Organisational Agility and 51.9% of the variance in Sustainable Performance. The R^2 for Organisational Agility is weak by commonly used benchmarks (Hair et al., 2021), indicating that digital transformation accounts for only a small share of agility and that other determinants were not examined.

➢ *Hypothesis Testing*

Table 7 Summary of Hypothesis Tests

Hypothesis	Relationship	β	t	p	Decision
H01	DT → SP	0.276	7.06	<0.001	Reject H01
H02	DT → OA	0.404	10.34	<0.001	Reject H02
H03	OA → SP	0.564	15.30	<0.001	Reject H03
H04	DT → OA → SP	0.228	8.08	<0.001	Reject H04

Source: Field Survey, 2026.

The direct relationship between Digital Transformation and Sustainable Performance remained positive after Organisational Agility was included in the model. This pattern indicates that Organisational Agility provides an indirect pathway through which Digital Transformation is associated with Sustainable Performance, while a direct relationship also remains.

B. Discussion of Findings

➢ *Digital Transformation and Sustainable Performance*

The study found a positive and statistically significant relationship between digital transformation and sustainable performance ($\beta = .276$, $p < .001$). The result indicates that manufacturing SMEs reporting higher levels of digital transformation also tend to report higher levels of sustainable performance.

The finding suggests that digital transformation may support the ability of manufacturing SMEs to improve organisational outcomes through more effective use of information, improved processes, coordination and innovation. Digital technologies can support operational efficiency and decision-making, which may contribute to economic outcomes. They may also provide opportunities for firms to monitor resource use, improve production processes and develop more sustainable practices.

The finding is consistent with the broader argument that digital transformation extends beyond technological adoption to organisational and strategic change. Verhoef et al. (2021) emphasise that digital transformation involves changes in organisational structures, capabilities and business activities. Similarly, Ulas (2019) notes that digital technologies can be applied across a range of SME activities, including manufacturing, marketing, sales and management.

The finding is also consistent with the sustainability and innovation literature. Nidumolu et al. (2009) argue that sustainability can encourage organisations to reconsider processes and develop innovative approaches, while Schaltegger and Wagner (2011) link sustainability innovation to the creation of economic, environmental and social value.

From the perspective of Dynamic Capabilities Theory, digital transformation can provide firms with technological and informational resources that support organisational adaptation. However, the statistically significant direct relationship found in this study should not be interpreted as evidence that digital transformation necessarily causes sustainable performance because the study employed a cross-sectional design. Rather, the result indicates that the two constructs are positively associated within the sampled manufacturing SMEs. The finding supports the rejection of $H_0 1$.

➢ *Digital Transformation and Organisational Agility*

The study found a positive and statistically significant relationship between digital transformation and organisational agility ($\beta = .404$, $p < .001$). This indicates that manufacturing SMEs with higher reported levels of digital transformation also tend to report stronger organisational agility.

The result is theoretically consistent with Dynamic Capabilities Theory. Digital technologies can improve information availability, communication, coordination and the speed with which organisations identify and respond to changes. These capabilities are relevant to sensing environmental developments and mobilising organisational resources in response.

The result is also consistent with Troise et al. (2022), who found that digital technology capability contributes to organisational agility among SMEs. Their findings suggest

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that digital technology capability, together with relational and innovation capabilities, can strengthen the ability of SMEs to respond to volatile environments.

The result further supports the argument that technology adoption should not be considered separately from organisational capability. Digital technologies may provide the information and infrastructure necessary for faster responses, but organisational processes and managerial capacity are required to convert these resources into action. The finding supports the rejection of $H_0 2$.

- *Organisational Agility and Sustainable Performance*

The study found a positive and statistically significant relationship between organisational agility and sustainable performance ($\beta = .564$, $p < .001$). The coefficient represents the strongest direct relationship in the structural model.

The finding indicates that manufacturing SMEs with greater organisational agility tend to report stronger sustainable performance. Agile firms may be better positioned to adjust their processes, reallocate resources and respond to changing market and operational conditions. These capabilities can support economic outcomes while also enabling organisations to respond to environmental and social requirements.

The finding is consistent with the view of Doz and Kosonen (2008) that organisational agility involves strategic sensitivity, collective commitment and resource fluidity. It also corresponds with evidence from Troise et al. (2022), who reported a positive relationship between organisational agility and SME performance outcomes.

The finding has particular relevance to manufacturing SMEs because they frequently operate with limited resources. An organisation's ability to make timely adjustments may therefore be important for maintaining performance when market conditions, customer requirements or production conditions change.

From a Dynamic Capabilities perspective, organisational agility reflects the organisational ability to reconfigure resources in response to environmental changes. The finding therefore provides empirical support for the proposition that organisational capability is relevant to sustainable performance. $H_0 3$ is therefore rejected.

- *Mediating Role of Organisational Agility*

The study found a positive and statistically significant indirect relationship between digital transformation and sustainable performance through organisational agility ($\beta = .228$, $p < .001$). The direct relationship between digital transformation and sustainable performance also remained statistically significant. This indicates partial mediation.

The finding suggests that digital transformation is associated with sustainable performance through two related pathways. First, digital transformation has a direct relationship with sustainable performance. Second, digital transformation is associated with organisational agility, which in turn is associated with sustainable performance.

The finding provides support for the capability-based explanation underlying the study. Digital technologies may provide information, connectivity and technological resources, but the organisational capability to respond to changing conditions may determine how effectively those resources are translated into performance outcomes.

Dynamic Capabilities Theory provides a particularly relevant explanation. Teece (2007) conceptualises dynamic capabilities around sensing, seizing and reconfiguring. Digital transformation may strengthen the information and technological resources available for sensing and responding to changes, while organisational agility represents an important capability for adjusting organisational activities and resources.

Absorptive Capacity Theory provides a complementary interpretive lens, although absorptive capacity itself was not measured in this study. Cohen and Levinthal (1990) argue that organisations need the ability to recognise, assimilate and apply external knowledge, while Zahra and George (2002) distinguish between potential and realised absorptive capacity. Digital transformation can increase the availability of digital information and knowledge, but firms must possess organisational capabilities to assimilate and apply those resources.

The partial mediation finding is therefore important because it indicates that digital transformation alone does not fully explain the observed relationship with sustainable performance. Organisational agility constitutes an additional pathway through which digital transformation is associated with performance. The finding supports the rejection of $H_0 4$.

V. CONCLUSION

This study examined the relationship between digital transformation and sustainable performance and assessed the mediating role of organisational agility among manufacturing SMEs in North Central Nigeria.

The findings indicate that digital transformation has a positive and statistically significant relationship with organisational agility and sustainable performance. Organisational agility also has a positive and statistically significant relationship with sustainable performance. The indirect relationship between digital transformation and sustainable performance through organisational agility is statistically significant, while the direct relationship remains significant. Organisational agility therefore partially mediates the relationship between digital transformation and sustainable performance.

The findings suggest that the value of digital transformation extends beyond the adoption of technologies. Manufacturing SMEs that combine digital transformation with the organisational capacity to respond to changing

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conditions are more likely to report stronger sustainable performance.

The findings also reinforce the relevance of Dynamic Capabilities Theory in explaining the relationship among digital transformation, organisational agility and sustainable performance. Digital resources provide opportunities for firms to obtain and use information, while organisational capabilities enable them to respond to changes and reconfigure resources. Absorptive Capacity Theory provides a complementary explanation by emphasising the ability of organisations to acquire, assimilate, transform and exploit knowledge.

However, the measurement results require careful interpretation. Sustainable performance was operationalised across economic, environmental and social dimensions, and the empirical evidence indicates that these dimensions are not strongly homogeneous as a single reflective construct. Consequently, the structural relationships should be interpreted as evidence of association within the specified research model rather than as proof of a fully validated unidimensional sustainable-performance construct.

Overall, the study provides preliminary evidence that digital transformation and organisational agility are important considerations in understanding sustainable performance among manufacturing SMEs in North Central Nigeria.

RECOMMENDATIONS

Based on the findings, the following recommendations are made.

- Manufacturing SMEs should approach digital transformation as an organisational development process rather than merely as the acquisition of digital equipment or software. Digital investments should be aligned with operational processes, information management, customer engagement, production activities and strategic objectives.
- SME owners and managers should strengthen organisational processes that enable timely responses to changes in markets, customer requirements and technology. This includes flexible decision-making, effective communication, timely access to information and the ability to reallocate resources when circumstances change.
- Investment in digital technologies should be accompanied by employee training, managerial development and process redesign. The findings indicate that organisational agility is strongly associated with sustainable performance and therefore deserves attention alongside digital technology adoption.
- Manufacturing SMEs should use digital technologies to address economic, environmental and social objectives simultaneously. Digital transformation initiatives should therefore consider operational efficiency, resource utilisation, environmental practices, employee and customer outcomes and longer-term organisational viability.
- Government institutions and SME-support organisations should design digitalisation programmes that combine access to technology with organisational capability development. Support programmes should include digital skills, managerial capabilities, process improvement and change management rather than focusing exclusively on hardware or software acquisition.

➢ *Contributions to Knowledge*

Policy contribution*:* This study provides actionable insights for policymakers to develop frameworks that support digital transformation and sustainable practices in manufacturing SMEs, which may support economic growth and competitiveness in North Central Nigeria. By implementing targeted policies that facilitate technology adoption and organisational agility, government may be better placed to foster a more resilient and innovative manufacturing sector.

Theoretical contribution: The research contributes to the academic literature by integrating concepts of digital transformation, organisational agility and sustainable performance, offering evidence on their interrelationships in the context of Nigerian manufacturing SMEs. Dynamic Capabilities Theory provides the main explanatory framework, while Absorptive Capacity Theory is used as a complementary interpretive lens and was not tested directly.

Practical contribution: The findings offer practical implications for SME owners and managers, emphasising the need for strategic alignment between digital initiatives and organisational agility to improve sustainable outcomes. By adopting the recommendations provided, SMEs may enhance their capabilities, which may in turn contribute to sustainable economic growth in North Central Nigeria.

LIMITATIONS OF THE STUDY AND FUTURE RESEARCH

➢ *Limitations*

The study has several limitations.

First, the cross-sectional design means that the data were collected at one point in time. The findings therefore establish statistical relationships rather than causal effects. Longitudinal studies may provide stronger evidence regarding how digital transformation and organisational agility develop over time and how these changes relate to sustainable performance.

Second, the study relied on self-reported questionnaire responses. Although appropriate for examining organisational perceptions and practices, self-reported measures may be affected by respondent perceptions and reporting tendencies. Single-respondent data may also be affected by common method bias, and the results of a formal common method bias assessment are not reported in this paper.

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Third, the study focused on manufacturing SMEs in North Central Nigeria. The findings may therefore not be directly generalisable to large firms, non-manufacturing SMEs or SMEs operating in other regions of Nigeria without further empirical examination. In addition, the sample was allocated equally between small and medium enterprises rather than in proportion to their population shares (about 91.5% small and 8.5% medium), and the results were not weighted.

Fourth, sustainable performance was measured through economic, environmental and social dimensions. The measurement results indicate that these dimensions do not exhibit strong homogeneity as a single reflective construct. Future studies should therefore consider modelling the dimensions separately or using an explicitly specified multidimensional higher-order measurement model. More broadly, convergent validity was not established for any construct (AVE below 0.50), and the structural estimates should be read in that light.

Finally, one response on the social-performance measure was outside the five-point response range specified by the questionnaire. This represents a data-quality issue that should be checked against the original questionnaire record where available.

- *Future Research*

Future research should consider longitudinal designs to examine how digital transformation and organisational agility develop over time and how changes in these capabilities relate to changes in sustainable performance. Further studies should also examine the economic, environmental and social dimensions of sustainable performance separately. Such an approach may reveal whether digital transformation and organisational agility relate differently to the individual dimensions.

Future research may extend the model by examining additional organisational capabilities, such as innovation capability, absorptive capacity, knowledge sharing, digital capability or strategic flexibility. These variables may provide further explanation of how digital transformation is translated into organisational outcomes.

Comparative studies across Nigerian regions may also provide useful evidence regarding whether the relationships identified in North Central Nigeria are consistent across different institutional, infrastructural and economic environments. Finally, mixed-method designs could provide deeper insight into how manufacturing SMEs implement digital transformation and how managers translate digital resources into organisational capabilities and sustainable outcomes.

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