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Exploring the role of digital innovation in enhancing small business competitiveness in manufacturing firms Owerri North, Imo state

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Abstract

In developing economies, small businesses must embrace digital innovation if they are to compete effectively with larger and more established firms. This study examines the impact of digital innovation on the competitive advantage of small-scale manufacturing enterprises in Owerri, Imo State, Nigeria. Specifically, the study focuses on the roles of e-commerce platforms, organizational agility, employee engagement, and resource optimization, while also considering operational innovation and customer satisfaction as key indicators of business performance. The study adopted a survey research design and utilized a structured questionnaire to gather data from 37 unregistered small-scale manufacturing firms located in Owerri North Local Government Area. Data collected were analysed using Pearson correlation and regression analysis techniques. The findings revealed a strong positive relationship between operational innovation and customer satisfaction ($r = 0.883$, $p < 0.01$). In addition, e-commerce platforms were found to significantly influence organizational agility ($\beta = 0.739$, $p < 0.01$), while employee engagement showed a very strong positive correlation with resource optimization ($r = 0.910$, $p < 0.01$). These results indicate that digital innovation contributes meaningfully to improved efficiency, responsiveness, and overall business competitiveness among small manufacturing firms. The study concludes that the strategic adoption of digital technologies significantly enhances the competitive position of manufacturing enterprises through better operational efficiency, improved market responsiveness, and more effective utilization of resources. Furthermore, the findings provide empirical support for the Resource-Based View, the Technology Acceptance Model, and Competitive Advantage Theory. The study is also practically relevant to entrepreneurs and policymakers seeking sustainable ways to strengthen the competitiveness of small businesses in emerging market environments such as Nigeria.

Keywords: Digital innovation; SMEs; Manufacturing firms; Owerri – Imo

1. Introduction

Digital innovation has emerged as a defining feature of contemporary business transformation, fundamentally altering how firms generate value, coordinate operations, and sustain competitiveness in increasingly volatile markets. The diffusion of technologies such as cloud computing, artificial intelligence, mobile applications, and e-commerce ecosystems has disrupted conventional business logic, enabling firms to redesign processes and unlock new sources of efficiency and market access. Within this evolving landscape, small and medium-sized enterprises (SMEs) are

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particularly positioned at a crossroads, where digital capability determines whether they remain constrained by structural limitations or evolve into agile and competitive actors in the global economy ((Prihandono *et al.,* 2024).

From a strategic perspective, digital transformation offers SMEs a pathway to overcome long-standing operational and market barriers. By embedding digital tools into their value chains, small firms can reduce transaction costs, enhance coordination efficiency, and extend their reach beyond geographical boundaries (Chen *et al.,* 2021). Empirical evidence increasingly suggests that digital capability is not merely an operational enhancement but a strategic resource that strengthens firm adaptability and resilience in dynamic environments (Ausat, 2025; Lanyi *et al.,* 2021). Consequently, SMEs that successfully integrate digital technologies are better equipped to respond to shifting consumer demands, intensifying competition, and rapidly changing technological ecosystems.

Despite these opportunities, a considerable proportion of SMEs continue to rely on traditional business models characterised by manual processes, fragmented information systems, and limited technological integration. Such practices often result in inefficiencies in inventory control, delayed decision-making, and reduced customer responsiveness, all of which constrain firm performance and competitiveness (Martínez-Peláez *et al.,* 2023). Moreover, reliance on conventional marketing and financial management systems further limits scalability and weakens firms' ability to compete in digitally integrated markets (Ruzi *et al.,* 2024). This persistence of outdated operational structures highlights a critical tension between the potential benefits of digital innovation and its uneven adoption across small business ecosystems.

Although existing studies have established the positive association between digital innovation and firm performance, significant gaps remain in understanding how specific dimensions of digital capability translate into competitive advantage within SMEs, particularly in emerging economies. Evidence remains fragmented, with limited consensus on how e-commerce adoption, organisational agility, employee engagement, and resource optimisation collectively influence operational innovation and customer outcomes. This study therefore seeks to address this gap by examining how digital innovation drives competitive advantage among small-scale manufacturing enterprises in Owerri North, Imo State, Nigeria, with a focus on operational innovation, customer satisfaction, organisational responsiveness, and resource efficiency.

2. Literature review

2.1. Conceptual Review

This study is anchored on the relationship between digital innovation, digital technologies in small business processes, and small business competitiveness. Digital innovation functions as the independent construct driving transformation in how firms create, deliver, and capture value within increasingly digitalised markets. It reflects the strategic application of technologies such as e-commerce platforms, cloud computing, mobile applications, and digital analytics to redesign business operations and improve performance outcomes. Nasiri *et al*. (2023) and Urbinati *et al*. (2020) emphasise that digital innovation extends beyond mere technology adoption, encompassing the reconfiguration of organisational processes, capabilities, and value creation systems. Within this framework, it serves as the primary force shaping efficiency gains, improved responsiveness, and stronger competitive positioning among small businesses.

Operationalisation of digital innovation occurs through interconnected technological and organisational mechanisms embedded in small business processes. E-commerce platforms expand market access and strengthen organisational responsiveness by enabling firms to reach broader customer segments and respond swiftly to changing demand conditions. This aligns with *Teoh et al*. (2022), who report that SMEs adopting e-commerce platforms significantly expanded their market reach within the first year of implementation. Cloud computing further enhances resource efficiency and operational flexibility by lowering infrastructure costs and improving scalability, with documented efficiency gains ranging between 20–45% (Prihandono *et al.,* 2024). Mobile applications, digital marketing systems, and CRM tools also improve customer engagement, retention, and communication effectiveness, thereby strengthening customer satisfaction and loyalty (Ruzi *et al.,* 2024). Together, these technologies reshape employee engagement and resource optimisation by streamlining workflows, improving coordination, and reducing operational inefficiencies.

Mediating the relationship between digital innovation and competitiveness are organisational responsiveness, employee engagement, resource optimisation, and operational innovation. Organisational responsiveness captures the ability of firms to adjust quickly to market dynamics, while employee engagement reflects how digital tools enhance productivity, motivation, and collaboration among staff. Resource optimisation focuses on the efficient allocation and utilisation of financial, technological, and human assets, whereas operational innovation reflects improvements in

business processes and service delivery systems. These variables play a critical role in translating digital capabilities into tangible performance outcomes such as improved efficiency and customer satisfaction.

Small business competitiveness represents the dependent construct in this framework, capturing the ability of firms to maintain market position, profitability, and sustainable growth within resource-constrained environments (Onyele *et al.,* 2025). Competitive advantage emerges when digital innovation is effectively integrated to enhance operational efficiency, customer value creation, and innovation capability Onyele & Ikwuagwu, 2023). As highlighted by Al Koliby *et al.* (2024) and Lányi *et al.* (2021), competitiveness is inherently multidimensional, encompassing market share, customer satisfaction, innovation performance, and operational efficiency. Accordingly, digital innovation is positioned as the central determinant that influences competitiveness both directly and indirectly through operational innovation, customer satisfaction, organisational responsiveness, and resource optimisation in small business contexts.

2.2. Theoretical Framework

2.2.1. Resource-Based View (RBV) Theory

Resource-Based View (RBV) theory, originally introduced by Penrose (1959) and later developed by Barney (1991), explains firm performance through the possession and deployment of strategic resources that are valuable, rare, inimitable, and non-substitutable (VRIN). Wang and Zhang (2025) argue that sustained competitive advantage emerges when firms control resources that competitors cannot easily replicate or replace. These resources extend beyond physical assets to include intangible capabilities such as knowledge, technological competencies, and organisational routines that evolve over time.

A core assumption of RBV is that firms are heterogeneous in their resource endowments, and such differences account for variations in performance outcomes. Resource mobility is also imperfect, meaning that transferring strategic resources across firms often reduces their value or effectiveness. Competitive advantage, therefore, depends on how effectively firms develop, combine, and deploy unique resource bundles that align with market opportunities and environmental demands.

In the context of digital innovation, RBV provides a strong explanatory lens for understanding how small businesses leverage digital capabilities as strategic resources. Digital tools such as e-commerce platforms, cloud computing systems, CRM technologies, and data analytics functions represent intangible assets that enhance efficiency, responsiveness, and market reach (Ausat, 2025). For SMEs, these digital capabilities help offset structural constraints such as limited capital, scale disadvantages, and restricted market access by creating unique value-generating processes that are difficult for competitors to imitate.

Application of RBV in this study emphasises that digital innovation extends beyond technology adoption to capability development and strategic resource integration. Nasiri *et al.* (2023) highlight that digital transformation requires continuous reconfiguration of organisational capabilities to maintain competitiveness in dynamic environments. This aligns with the dynamic capability perspective, which stresses learning, adaptation, and resource reconfiguration as essential for sustained advantage in rapidly changing markets (Wang *et al.,* 2023). However, RBV has been criticised for its internal focus, static orientation, and circular reasoning, where resource value is sometimes inferred from performance outcomes rather than independently defined (Chen *et al.,* 2021).

2.2.2. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM), developed by Davis (1985), originates from the Theory of Reasoned Action and explains user acceptance of information systems. The model proposes that perceived usefulness and perceived ease of use are the primary determinants of technology adoption intentions, which subsequently influence actual usage behaviour (Chen *et al.,* 2021). Perceived usefulness refers to the extent to which an individual believes that using a technology enhances performance, while perceived ease of use reflects the degree to which the system is free of effort.

TAM assumes that behavioural intention is shaped by attitudes formed through these perceptions, and intention directly predicts actual technology use. In small business contexts, these perceptions are critical in determining whether digital tools are adopted or resisted. Ruzi *et al.* (2024) emphasise that SMEs are more likely to adopt digital technologies when they perceive clear performance benefits, particularly in areas such as efficiency, customer engagement, and competitiveness.

Within SMEs, perceived ease of use becomes especially significant due to limited technical skills, financial constraints, and restricted access to training. El-Haddadeh (2020) notes that complex or difficult-to-use technologies often face

resistance even when they offer substantial performance advantages. Therefore, adoption decisions are shaped not only by expected benefits but also by the perceived effort required to implement and use digital systems effectively.

Extensions of TAM incorporate external factors such as organisational readiness, cost considerations, and competitive pressure, which are particularly relevant in SME environments. Despite its usefulness, TAM has been criticised for its limited explanatory power regarding long-term usage, organisational-level dynamics, and broader socio-cultural influences. Lányi *et al.* (2021) further argue that the model overemphasises individual cognition while underrepresenting environmental and institutional factors that shape technology adoption outcomes.

2.2.3. Theoretical Justification for the Study

Combining RBV and TAM offers a more comprehensive theoretical foundation for understanding digital innovation in SMEs. RBV explains how digital technologies function as strategic resources that enhance competitiveness through capability development, resource integration, and value creation. In contrast, TAM explains the behavioural mechanisms underlying the adoption of these technologies, focusing on perceived usefulness, perceived ease of use, and user intention (Chen *et al.,* 2021; Wang and Zhang, 2025).

This integrated perspective is particularly relevant for SMEs operating in resource-constrained and highly competitive environments. While RBV captures the strategic and capability-based dimension of digital innovation, TAM explains the behavioural and perceptual factors that influence whether such innovations are adopted in the first place. Ausat (2025) and Nasiri *et al.* (2023) emphasise that digital transformation in SMEs requires both capability development and willingness to adopt, making the integration of both theories essential.

Together, both frameworks provide a holistic explanation of how digital innovation translates into improved operational efficiency, customer satisfaction, and small business competitiveness. RBV clarifies the "what" and "how" of value creation through digital capabilities, while TAM explains the "why" behind technology adoption decisions. This dual-theoretical approach strengthens the explanatory power of the study in examining digital innovation within small business environments.

2.3. Empirical Review

Empirical evidence consistently demonstrates that digital platforms significantly enhance SME competitiveness by expanding market access and improving customer reach. Teoh *et al.* (2022), focusing on Malaysian SMEs, found that firms adopting digital platforms recorded an average 35% increase in market coverage within the first year of implementation. Similarly, Martínez-Peláez *et al.* (2023) compared digital and traditional SMEs and reported that digitally transformed firms achieved 40–60% higher revenue growth, reinforcing the argument that digital transformation directly improves financial performance and long-term sustainability. These studies collectively highlight digitalisation as a key driver of market expansion and profitability in small business environments.

Operational efficiency gains associated with specific digital technologies have also been widely documented. Prihandono *et al.* (2024) revealed that cloud computing improves operational efficiency and flexibility by 20–45% while reducing IT infrastructure costs by 25–30%, particularly among Indonesian SMEs. In a related study, Al Koliby *et al.* (2024) demonstrated that integrated digital marketing strategies reduce customer acquisition costs by up to 50% while strengthening competitive positioning. Likewise, Ruzi *et al.* (2024) established that mobile applications enhance customer retention by approximately 25%, while Wang and Zhang (2025) found that data analytics adoption increases customer acquisition probability by 23 times and profitability likelihood by 19 times. These findings collectively reinforce the role of digital tools in improving efficiency, customer engagement, and financial outcomes.

Beyond performance and efficiency, digital innovation has been linked to improved organisational capability, innovation capacity, and resilience. Li *et al.* (2023) found strong positive relationships between digital transformation and innovation performance, indicating that digital technologies significantly enhance firms' ability to develop new products and services. Similarly, Al Omoush *et al.* (2025) reported that digitally transformed SMEs exhibit higher resilience and frugal innovation capacity, enabling them to withstand market shocks in emerging economies. Chen *et al.* (2021) further emphasised the importance of government support in strengthening digital adoption outcomes, while El-Haddadeh (2020) highlighted that successful digital transformation depends on organisational capability development and change management rather than technology adoption alone. These studies collectively suggest that digital transformation is a multidimensional process involving technology, capability, and institutional support.

Despite the strong global evidence on the benefits of digital innovation, a clear research gap remains in the context of developing economies, particularly Nigeria. Most existing studies (Teoh *et al.,* 2022; Prihandono *et al.,* 2024; Al Koliby

et al., 2024; Wang and Zhang, 2025) are concentrated in Asian and other developed emerging markets, leaving limited empirical evidence on how digital innovation translates into competitive advantage within Nigerian small manufacturing enterprises. Furthermore, there is a lack of studies that simultaneously examine the relationships between operational innovation and customer satisfaction, e-commerce platforms and organisational agility, as well as employee engagement and resource optimisation within the specific context of Owerri, Imo State. This study therefore addresses this gap by providing context-specific empirical evidence on how digital innovation influences the competitiveness of small-scale manufacturing firms in a uniquely constrained environment characterised by infrastructural challenges, informal enterprise structures, and evolving digital adoption patterns.

3. Methodology

3.1. Research Design and Data

This study employed a survey research design, which involves a systematic investigation of the activities, opinions, and characteristics of a defined group of people within their natural or institutional setting in order to collect relevant data. According to McCombes (2023), research design refers to a detailed framework for answering research questions using empirical evidence. In this study, the survey research design was considered appropriate because it enabled the collection of standardised data from numerous small manufacturing firms in the Owerri North Local Government Area, Owerri, Imo State, thereby facilitating the examination of relationships between dimensions of digital innovation and indicators of small business competitiveness. The survey method allowed the researcher to gather quantitative data that could be statistically analysed to test hypotheses relating to operational innovation and customer satisfaction, e-commerce platforms and organisational agility, and employee engagement and resource optimisation. This design also made it possible to capture data at a specific point in time, providing a snapshot of the current level of digital innovation adoption and competitiveness among manufacturing firms in the study area.

A structured questionnaire served as the primary instrument for data collection in this study. This method was adopted because it allows for the systematic collection of data from a relatively large number of respondents, ensures standardisation of responses, facilitates quantitative analysis, and is cost-effective for reaching manufacturing firms dispersed across Owerri North LGA, Imo State, Nigeria. The use of a questionnaire also enhanced comparability of responses and improved the efficiency of data collection within the limited time available for the study.

During the design of the questionnaire, careful attention was given to the study variables, particularly the dimensions of digital innovation, including operational innovation, e-commerce platforms, and employee engagement, as well as competitiveness indicators such as customer satisfaction, organisational agility, and resource optimisation. The instrument was divided into five sections, labelled A to E, with structured items measured on a Likert scale to ensure clarity and consistency in responses. Administration of the questionnaire was carried out personally by the researcher, with assistance from trained research assistants, targeting owners, managers, and key employees of selected small manufacturing firms in Owerri. This approach helped to improve the response rate, allowed for clarification of items where necessary, and reduced the likelihood of incomplete or invalid responses.

3.2. Sample Size Determination

In this study, the sample size of the population was determined statistically using the Taro Yamane (1967) formula as cited in Singh and Masuku (2014). The formula is expressed as:

$$n= N/1 + N e^(2)$$

Where:
n = sample size
N = Total population (estimated at 50)
e = allowable error limit (0.05 or 5%)

Applying the formula: $n = 44.4 \approx 44$

Therefore, the sample size for this study was 44 small unregistered manufacturing firms in Owerri North Local Government Area, Imo State, Nigeria.

3.3. Sampling Technique

This study employed a stratified random sampling technique to ensure proportionate representation of different manufacturing subsectors in the sample. The population was first stratified into five subsectors (food processing, textile and garments, furniture and wood products, chemical products and others), and then simple random sampling was used to select firms from each stratum proportionate to their representation in the population.

Table 1 Sample Distribution by Manufacturing Subsector

Manufacturing Subsector	Population	Proportion (%)	Sample Size
Food Processing	14	28.0	12
Textile and Garments	11	22.0	10
Furniture and Wood Products	10	20.0	9
Chemical Products	8	16.0	7
Others	7	14.0	6
Total	50	100.0	44

Source: Researcher's Computation (2025)

The stratified random sampling technique was chosen because it ensures that all manufacturing subsectors are adequately represented in the sample, reduces sampling bias, and allows for comparative analysis across different subsectors while maintaining the statistical generalizability of findings to the entire population.

3.4. Validity of Instrument

Validity refers to the quality of a data collecting instrument or procedure that enables it to measure effectively and accurately what it is supposed to measure. It entails the degree to which evidence and theory support the interpretation of test scores as cited in Ekundayo and Ekundayo (2018). Ensuring the validity of the research instrument was critical for this study to guarantee that the questionnaire accurately measured the constructs of digital innovation dimensions and small business competitiveness indicators.

The outcome of a pilot study was used to determine the validity of the survey measures. Specifically, this study utilized both content validity and construct validity of the measures. The content validity was determined based on the critical judgments and expert opinions and other experts in entrepreneurship, innovation management, and digital business transformation from the Department of Entrepreneurship and Innovation, Federal University of Technology, Owerri.

Ten small manufacturing companies who were not part of the final sample participated in the pilot study to evaluate the questionnaire's suitability, comprehensiveness, and clarity. Pilot study participants' comments on unclear questions, challenging terminology, and difficulties with response format were meticulously recorded. The instrument was altered multiple times to make sure that every question was understandable, pertinent, and able to capture the intended structures, taking into consideration the observations made by the pilot research participants as well as suggestions from supervisors and subject matter experts.

By ensuring that the questionnaire items were developed using recognized theoretical frameworks (such as Resource-Based View Theory, Technology Acceptance Model, and Competitive Advantage Theory) and operationalized in accordance with dimensions found in the literature review, construct validity was established. The conceptual definitions and empirical indicators found in earlier research by Prihandono *et al.* (2024), *Teoh et al.* (2022), and Al Koliby *et al.* (2024) were reflected in the questionnaire items evaluating operational innovation, e-commerce platforms, and staff engagement.

3.5. Reliability of Instrument

The degree of stability and consistency of a measurement process or tool is referred to as reliability. It shows how consistently the research tool yields results when used repeatedly in comparable circumstances. The Cronbach's Alpha coefficient, which gauges the internal consistency of scale items, was used in this study to evaluate the questionnaire's reliability. Nunnally (1978) states that reliability may be established with Cronbach's Alpha values greater than 0.70. The instrument was judged to be extremely reliable and appropriate for the primary data collection since every segment of the questionnaire produced Cronbach's Alpha scores over 0.80. The strong reliability coefficients show that the

instrument would yield consistent results across administrations and that the questionnaire items consistently measured the target constructs.

3.6. Operational Measures of Variables

The proxy values or predictors of the variables in the hypotheses, as shown in Table 2, were the main emphasis of this section. Determining how theoretical conceptions will be empirically measured using certain indicators or questionnaire items is known as operational measurement.

Table 2 Operational Measures of Variables

Hypothesis	Independent Variable	Operational Measure	Dependent Variable	Operational Measure
H_{01}	Operational Innovation	Use of automated production systems, digital inventory management, and workflow optimization tools	Customer Satisfaction	Reduction in complaints, faster service delivery, consistent quality, and improved retention rates
H_{02}	E-commerce Platforms	Online sales channels, digital payments, website functionality, and e-commerce transaction volume	Organizational Agility	Quick response to market changes, flexibility in offerings, and rapid decision-making capability
H_{03}	Employee Engagement	Staff participation in digital initiatives, skills training, and involvement in technology decisions	Resource Optimization	Cost reduction, efficient resource use, waste minimization, and productivity improvement

Source: Researcher's computation (2025)

Multiple items on a 5-point Likert scale, with 1 denoting "strongly disagree" and 5 denoting "strongly agree," were used to measure each characteristic. By capturing many aspects of each variable and lowering measurement error, this multi-item assessment strategy improves the constructs' validity and reliability.

3.7. Data Analysis Techniques

Descriptive and inferential statistical methods were used to assess the data obtained from questionnaires. After the surveys were completed and coded, the data was entered for analysis using Microsoft Excel's Data Analysis Tool Pack. Descriptive Statistics: In order to describe the levels of digital innovation adoption and competitiveness indicators among small manufacturing enterprises in Owerri, as well as to summarize the demographic features of the respondents and firms, frequency distributions, percentages, means, and standard deviations were calculated.

Inference Statistics: Pearson Product-Moment Correlation the study assumptions have been tested using coefficient analysis, which looks at the connection between independent variables (operational innovation, e-commerce platforms, and employee engagement) and dependent variables (customer satisfaction, organizational agility, and resource optimization). The Pearson correlation coefficient, denoted as r, is the measure indicating the strength and direction of the linear relationship between two continuous variables ranging from -1 to +1.

Decision Rule: If the correlation coefficient is statistically significant either at a 0.05 or 0.01 significance level ($p < 0.05$ or $p < 0.01$) and the value of the correlation shows a relevant relationship among the variables, then the null hypothesis will be rejected, and the alternative hypothesis will be accepted. On the other hand, if the correlation coefficient is not statistically significant ($p > 0.05$), the null hypothesis will be accepted; this implies no significant relationship among the variables.

4. Results

After successfully distributing out 44 questionnaires, 40 responses were returned. However three of the responses were incomplete and were therefore excluded from the analysis. 37 responses were duly filled and returned as detailed in table 3.

4.1. Demographic Characteristics of Respondents

This section presents the demographic profile of respondents from the 37 small manufacturing firms surveyed in Owerri North Local Government Area, Imo State, Nigeria.

Table 3 Demographic Distribution of Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	28	75.7
	Female	9	24.3
Age	18-25 years	16	43.2
	26-35 years	14	37.8
	36-45 years	5	13.5
	46-55 years	1	2.7
	56 years and above	1	2.7
Educational Qualification	SSCE/WAEC	3	8.1
	OND/NCE	5	13.5
	HND/B.Sc.	21	56.8
	M.Sc./MBA	8	21.6
Position	Owner	14	37.8
	Manager	11	29.7
	Supervisor	3	8.1
	Employee	9	24.3
Years in Operation	Less than 1 year	4	10.8
	1-3 years	13	35.1
	4-6 years	11	29.7
	7-10 years	5	13.5
	Above 10 years	4	10.8

Source: Field Survey (2025)

Table 3 clearly shows that the respondents were male respondents 28 (75.7%) and the remaining 9 (24.3%) of the respondents were females. The findings show that the bulk of respondents aged between 18 years and 25 years making up 43.2% of respondent. Thereafter the second major age group is composed of respondent aged between 26 years and 35 years making up 37.8% of respondent.

Those respondents with HND/B.Sc were qualified to answer qualification numbered 21(56.8%).

4.2. Descriptive Statistics of Study Variables

Table 4 presents the descriptive statistics for all key variables examined in this study.

Table 4 Descriptive Statistics of Study Variables

Variable	Mean	Std. Error	Median	Mode	Std. Deviation	Min	Max
Operational Innovation	3.83	0.12	4.00	4.20	0.70	2.40	5.00
E-Commerce Platforms	3.90	0.12	4.00	4.20	0.74	2.00	5.00
Employee Engagement	3.78	0.11	4.00	4.00	0.68	2.20	5.00
Customer Satisfaction	4.10	0.10	4.20	4.20	0.62	2.80	5.00
Organizational Agility	3.98	0.11	4.00	4.00	0.68	2.80	5.00
Resource Optimization	3.96	0.12	4.00	4.00	0.71	2.40	5.00

Table 4 shows that all variables recorded mean scores above 3.78, indicating generally positive perceptions regarding digital innovation adoption and competitiveness indicators. Customer Satisfaction achieved the highest mean score (4.10), followed by Organizational Agility (3.98) and Resource Optimization (3.96). The standard deviations ranged from 0.62 to 0.74, suggesting moderate variability in responses.

4.3. Test of Hypotheses

4.3.1. Relationship between Operational Innovation and Customer Satisfaction

H_{01}: There is no relationship between operational innovation and customer satisfaction in manufacturing firms.

Table 5a Pearson Correlation Analysis - Operational Innovation and Customer Satisfaction

Variables	Operational Innovation	Customer Satisfaction
Operational Innovation	1.000	
Customer Satisfaction	0.883	1.000

Note: Correlation is significant at the 0.01 level (2-tailed); Correlation Coefficient (r): 0.883; Significance Level: $p < 0.01$; N: 37

The table 5.1 operational innovation on the one hand, customer satisfaction on the other. The findings suggest that the operational innovation has a positive relationship with customer satisfaction. This refers that Customer satisfaction is influenced and correlated with 88.3% operational innovation. We reject the null hypothesis H_{01} because the p-value is lower than 0.05, so we conclude manufacturing firms' customer satisfaction and operational innovation are significantly positively linked.

4.4. Influence of E-Commerce Platforms on Organizational Agility

H_{02}: E-commerce platforms do not significantly influence organizational agility in manufacturing firms.

Table 5b Regression Analysis - E-Commerce Platforms and Organizational Agility

Regression Statistics					
Multiple R		0.807			
R Square		0.651			
Adjusted R Square		0.641			
Standard Error		0.407			
Observations		37			
ANOVA	df	SS	MS	F	Significance F
Regression	1	10.816	10.816	65.197	1.66×10^{-9}
Residual	35	5.806	0.166		

Total	36	16.623			
Coefficients		Coefficient	Standard Error	t Stat	P-value
Intercept		1.099	0.363	3.027	0.005
E-Commerce Platforms		0.739	0.092	8.075	1.66×10^{-9}

Note: Significant at the 0.01 level

Table 5.2 presents how the e-commerce platform's influence affects the firm's organizational agility. The value of R square is 0.651, which means that e-commerce platform explain 65.1 per cent variation in organizational agility. The overall performance of regression the model can be tested by F-statistics (65.197, $p < 0.01$). The analysis reveals that the regression coefficient is estimated at 0.739. The t-value is 8.075 and the p-value is less than 0.01. Hence, these values indicate that e-commerce platform positively influence organizational agility. Hence, each unit increase in an e-commerce platform enhances organizational agility by 0.739 units. Study results show H03 has been rejected as e-commerce platforms significantly influence organizational agility in manufacturing firms

4.5. Relationship between Employee Engagement and Resource Optimization

H_{03}: There is no significant relationship between employee engagement and resource optimization in manufacturing firms.

Table 5c Pearson Correlation Analysis - Employee Engagement and Resource Optimization

Variables	Employee Engagement	Resource Optimization
Employee Engagement	1.000	
Resource Optimization	0.910	1.000

Correlation Coefficient (r): 0.910; Significance Level: $p < 0.01$; N: 37; Note: Correlation is significant at the 0.01 level (2-tailed)

Table 5.3 shows Pearson correlation analysis of employee engagement and resource optimization. The relationship is positive and very strong, $r = 0.910$, $p < 0.01$. This means the coefficient is significant at the one percent level. Furthermore, the coefficient of correlation reveals that 91.0% of changes in resource optimization are instigated by employee engagement towards digital innovation. According to the decision rule, we reject H_{03}. Therefore, there exists a highly favorable relationship between the engagement of employees and the manufacturing firms' resource optimization.

5. Discussion

5.1. Operational Innovation and Customer Satisfaction

The results in Table 5.1 indicate a positive significant correlation ($r = 0.883$, $p < 0.01$) between operational innovation and customer satisfaction among manufacturing companies. This finding indicates that companies that have adopted automated production systems, digital inventory management, and workflow optimization software are clearly enjoying levels of customer satisfaction improvements. The large magnitude of the correlation coefficient indicates that as manufacturing companies embrace operational innovation technology, customer satisfaction levels rise proportionately. This result supports Resource-Based View theory assumptions that companies which create distinctive digital capabilities build lasting competitive advantage. With that high correlation in this case, the hypothesis holds that operations-level innovation is an extraordinary and scarce resource that adds value to the firm by enabling higher service delivery and product quality consistency.

The empirical evidence derived from this study corroborates previous research by Prihandono *et al.* (2024), who found that process improvement-focused digital transformation efforts create noteworthy performance improvements in SMEs, particularly in the area of operational performance. Similarly, Tang *et al.* (2023) demonstrated that process innovation through digitalization enhances organizational performance through the acceleration of decision-making speed and the reduction of operating costs. This research contributes to these results by measuring the exact extent of the relationship in the Nigerian manufacturing sector. The managerial implication of this observation, as evident from Table 5.1, is that manufacturing companies in Owerri who are in search of a boost in customers' satisfaction would do well to invest more resources in operational innovation technologies. The correlation confirms that computerized

systems, computerized inventory management, workflow streamlining, have a direct link with fewer complaints, quicker delivery of services, reliability in quality, and better retention rates—precise measures of customer satisfaction studied in this research.

5.2. Electronic commerce platforms and organizational adaptability

Table 5.2 shows that e-commerce websites have a significant effect on organizational agility ($\beta = 0.739$, $p < 0.01$), accounting for 65.1% of variance in e-commerce adoption organizational agility. The significant effect suggests that web-based selling channels, electronic payment infrastructures, and social media sites empower manufacturing companies to establish superior capabilities to handle fast response to dynamic markets, keep themselves flexible in product offerings, and exhibit rapid decision-making capabilities. The regression analysis supports Technology Acceptance Model's postulation that perceived usefulness and perceived ease of use explain technology adoption and organizational performance. The positive and significant coefficient shows companies finding e-commerce platforms useful for business purposes build greater organizational agility. As is evident from Figure 4.2, both e-commerce platforms (mean = 3.90) and organizational agility (mean = 3.98) rated higher than the midpoint, indicating mass adoption and favorable performance.

These results align with empirical findings by Teoh *et al.* (2022), who established that firms implementing digital platforms saw their mean 35% increase in market coverage over a year. The study goes on to show that apart from improving market reach, e-commerce platforms significantly change organizational flexibility and responsiveness. Al Koliby *et al.* (2024) also found stable relationship between e-marketing capability and sustainable competitive performance, as in line with this research evidence that e-commerce platforms enhance competitive positioning through heightened agility. The F-statistic of 65.197 ($p < 0.01$) in Table 4.4 is also a strong testament to the strength of the relationship, affirming that the effect of e-commerce platforms on organizational agility is no accident. For business firms in developing nations like Nigeria, this finding implies that strategically investing in e-commerce infrastructure has measurable impacts of organizational responsiveness. The ability to quickly adapt to changes in customer requirements, outcompete competitors with faster decision-making, and adopt new technologies at fast speeds tallies for organizational agility are enhanced by a significant magnitude with the use of e-commerce platforms.

5.3. Employee Engagement and Resource Optimization

The correlation result in Table 5.3 shows a strong positive correlation between manufacturing company resource optimization and employee engagement ($r = 0.910$, $p < 0.01$). The result is the strongest among all the hypotheses that are tested under this study, an indication that employee involvement in technology decision-making participation, skills training, and digital innovation projects are decisive determinants of effective resource use. The finding provides strong empirical support for the Competitive Advantage Theory's emphasis on human capital as a means of achieving competitive advantage. The high correlation coefficient indicates that firms with greater employee involvement in digital transformation activities achieve much greater benefits such as cost reductions, best usage of resources, elimination of wastage, and improved productivity. Both employee engagement (mean = 3.78) and resource optimization (mean = 3.96) were rated positively.

The result is consistent with Wang and Zhang (2025) research that found organizational forces and employee engagement contribute significantly to digital transformation success and business performance. This study measures this relationship in manufacturing precisely, showing that 91.0% of the variance in optimizing resources is explained by employee engagement. This much closer correlation than in the case of the first two hypotheses indicates human rather than technology variables may be even more pivotal in providing operating efficiencies. In fact, it confirms that digital technologies will not be capable of providing optimal utilization of resources merely by adopting them in production companies; they need to invest in employee engagement activities as well. The strong correlation indicates that companies where employees are strongly engaged with digital projects, get frequent training, submit ideas for process improvement, and demonstrate strong commitment in adopting new technologies have markedly enhanced resource optimization results than those companies where there is weaker employee engagement.

The descriptive statistics reported in Table 2 offer further insight, indicating that all variables had positive scores, yet the variance for employee engagement (SD = 0.68) indicates that companies vary in how effectively they involve employees in digital transformation. Those that can engage employees seem to realize significant competitive advantage through best-practice-aligned resource management, further supporting the theoretical contention that complementary organizational capabilities are required in order to unlock value from digital investments (Nasiri *et al.*, 2023).

5.4. General Implications

Together, the results show that digital innovation greatly improves small business competitiveness in manufacturing companies in many ways. The strong correlation rates captured in all three hypotheses operational innovation-customer satisfaction (r = 0.883), e-commerce platforms-organizational agility (β = 0.739), and employee engagement-resource optimization (r = 0.910) afford strong empirical evidence for the research's overarching argument.

The age demographic profile indicates that these gains are going to comparatively young companies (64.8% lasting 6 years or less) with more highly qualified staff (78.4% with HND/B.Sc. or higher level qualifications), implying that newer manufacturing companies with better qualified staff are likely to be able to take advantage of digital innovation for competitive gain. The proportion of different manufacturing subsectors as shown in Figure 4.1 supports the fact that these observations are consistent for the different types of manufacturing being researched.

These findings bridge the research gap outlined in Chapter Two throughout the lack of empirical findings of how particular digital technologies emerge as competitive strengths for Nigerian emerging market SMEs. The research provides implementation evidence in favor of the theoretical models used Resource-Based View, Technology Acceptance Model, and Competitive Advantage Theory and provides actionable findings for entrepreneurs and policymakers that aim to increase manufacturing SME competitiveness through strategic application of digital innovation.

6. Conclusion

This study provides empirically grounded evidence on the role of digital innovation in enhancing the competitiveness of small-scale manufacturing firms in Owerri, Imo State, Nigeria. Findings from the tested hypotheses confirm that operational innovation significantly improves customer satisfaction, e-commerce platforms enhance organisational agility, and employee engagement strengthens resource optimisation, collectively demonstrating that strategic digital technology adoption yields substantial competitive advantages in emerging market SMEs. The results are theoretically supported by the Resource-Based View Theory, which explains digital capabilities as inimitable strategic resources; the Technology Acceptance Model, which accounts for adoption behaviour based on perceived usefulness and ease of use; and Porter's Competitive Advantage Theory, which highlights how digital innovation enables both cost leadership and differentiation. Notably, the strongest relationship observed between employee engagement and resource optimisation underscores that technology alone is insufficient without complementary investment in human capital, training, and organisational culture that supports innovation and digital adoption.

Practically, the study shows that digital tools such as automated systems, e-commerce platforms, and digital workflow solutions directly enhance service efficiency, responsiveness, and customer satisfaction, while also enabling firms to overcome geographical limitations and respond more effectively to market changes. However, variation in implementation effectiveness suggests that financial constraints, resistance to change, and limited technical capacity continue to hinder optimal digital transformation outcomes among small firms. The demographic profile of relatively young and educated entrepreneurs indicates strong potential for digital adoption, yet structural barriers remain significant.

Several limitations were identified, including the restriction of the study to unregistered small manufacturing firms in Owerri North LGA, the cross-sectional design which limits causal inference and long-term analysis, reliance on self-reported data which may introduce bias, and the relatively small sample size which may constrain broader generalisation. Despite these limitations, the study contributes meaningfully to the literature by providing context-specific empirical evidence from a Nigerian emerging market, where infrastructural and institutional conditions differ from those in developed economies, thereby strengthening understanding of how digital innovation translates into competitive advantage in resource-constrained environments.

Recommendations

The study concludes with several strategic recommendations directed towards parties with a view to promoting competitiveness of small manufacturing firms through adoption of digital innovation in Owerri, Imo State and similar emerging market contexts based on the empirical facts and conclusions of the study.

Make extensive investments in operational technologies such as automation and digital inventory systems to enhance customer satisfaction. Make sure such investments are assessed and implemented in stages so they cause the least disruption and allow for the most gradual learning.

Developing an e-commerce strategy that focuses on integrated sales platforms and payment gateways will make the business operations agile. Consider your online platform as your core business capability and invest in its development, SEO, and performance monitoring so that you can assess return on investment.

Formal training and involvement programs need to be established to ensure employee engagement is a critical success factor for digital transformation. Develop a culture of innovation that encourages employees to continually acquire new skills and reward creative solutions that optimize ROI on technology.

Creating scalable, low-cost technologies that are designed for user-friendliness is essential for smaller manufacturers. They must support these with rich training, ongoing technical support and personalized subscription pricing to help overcome the adoption barriers.

Future studies on the long-term sustainability of digital advantages should deploy panel datasets. There is a need for comparative studies across geographies, firm sizes etc. Qualitative case studies and particular technologies or approach studies will provide more granular and credible guidance to practitioners and entrepreneurs.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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