

“THE DIGITAL AND GREEN ECONOMY: DUAL ENGINES RESHAPING GROWTH, RESILIENCE, AND EQUITY IN EMERGING MARKETS”

Research Paper

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“Abstract “

The convergence of digital transformation and the green economy is reshaping business strategies and economic policy frameworks worldwide. This paper investigates how the integration of e-commerce, ERP systems, and sustainability principles when jointly adopted drive operational efficiency, competitiveness, and inclusive growth even in emerging markets. Using mixed-methods empirical evidence from Nigerian Small and Medium-Sized Textile Enterprises (SMTEs), the study applies the Technology-Organization-Environment (TOE) and Resource-Based View (RBV) frameworks to evaluate synergies between digital adoption and environmental, social, and governance (ESG) integration. Findings demonstrate that digital-green strategies enhance efficiency, resilience, and financial sustainability, enabling emerging economies to leapfrog traditional development pathways. Policy implications include the design of enabling ecosystems, financial incentives, and capacity-building programmes to accelerate convergence. The paper contributes to literature on sustainable digitalisation and offers actionable insights for policymakers, managers, and development agencies.

Keywords: Digital transformation, green economy, operational efficiency, sustainable financial growth

1 Introduction

Global economies are undergoing profound transformations driven by two major forces: the digital revolution and the green transition. Digital technologies such as e-commerce platforms, ERP systems, artificial intelligence (AI), blockchain, and cloud computing are reshaping industries by enabling real-time decision-making, customer-centric business models, and resource optimisation. Simultaneously, the global push for sustainability is accelerating through green economy initiatives, circular economy practices, and environmental, social, and governance (ESG) frameworks. These tools enable efficient, data-driven operations and enhanced customer experiences. Simultaneously, the global push for sustainability is accelerating through policies, investments, and innovations that promote low-carbon growth and resource efficiency.

According to the World Bank (2024), digital technologies could raise productivity in developing economies by as much as 40%, while green economy initiatives are projected to generate over US\$10 trillion in new economic opportunities by 2030 (WEF, 2023). Together, these shifts are creating new opportunities for sustainable economic growth, while also posing significant challenges for businesses in emerging markets.

In Nigeria, SMEs constitute 97% of enterprises and employ 84% of the workforce (SMEDAN, 2022), making them critical to national economic performance. Within this sector, the textile industry—once a

major contributor to GDP—has suffered decline due to weak infrastructure, global competition, and limited technological adoption. My doctoral research (Aduaye-Odiete, 2025) on digital transformation in Lagos SMTEs found measurable improvements in sales growth, customer satisfaction, and operational efficiency following digital adoption. However, adoption remains fragmented, with limited integration of green practices. This study therefore addresses a gap: how digital and green strategies can be co-adopted to generate synergistic impacts on operational and financial outcomes in emerging markets.

2. Literature Review

2.1 Digital transformation in SMEs

Digital transformation refers to the application of digital technologies to fundamentally alter how businesses operate and deliver value (Bharadwaj et al., 2013). In SMEs, digitalisation manifests primarily through e-commerce and ERP adoption. E-commerce expands market access and customer engagement, while ERP systems integrate business processes, streamline supply chains, and enhance decision-making (Zhu et al., 2021).

The study which best fits under the topic of “Industry and Business Transformation” focuses on how businesses – particularly SMEs in emerging markets are transforming their operational models in response to digital and sustainability imperatives. While elements of technological innovation are evident, especially through digital tool adoption, they serve more as enablers of broader strategic and structural business changes, which justifies technology innovation as a secondary theme. Supporting data from my DBA thesis indicates that over 68% of surveyed SMTEs in Lagos Nigeria experienced improved operational efficiency and 54% reported enhanced financial performance within one year of adopting ERP systems and e-commerce platforms (Aduaye-Odiete, 2025), though high costs, inadequate IT infrastructure, and limited expertise remain barriers. Case studies in other contexts (e.g., Saudi Arabia, Iran) also show ERP and e-commerce improve inventory control, cost reduction, and export growth (AlBar and Hoque, 2019; Ghobakhloo and Tang, 2021).

2.2 Green economy and ESG integration

The green economy promotes growth while ensuring environmental protection, social inclusion, and responsible governance. ESG frameworks provide operational and reporting standards for embedding sustainability into core business activities. Empirical studies show SMEs adopting ESG improve access to finance, customer loyalty, and long-term profitability (Saxena et al., 2023). Eco-efficient manufacturing enhances profitability while reducing waste (Alkhoraif et al., 2019), so demonstrates that integrating sustainability into core business operations can reduce waste, enhance brand value, and improve long term profitability.

Yet adoption in African SMEs is low, partly due to poor awareness, regulatory gaps, and cost barriers. Integrating sustainability practices into SMEs requires incentives, policy support, and knowledge transfer.

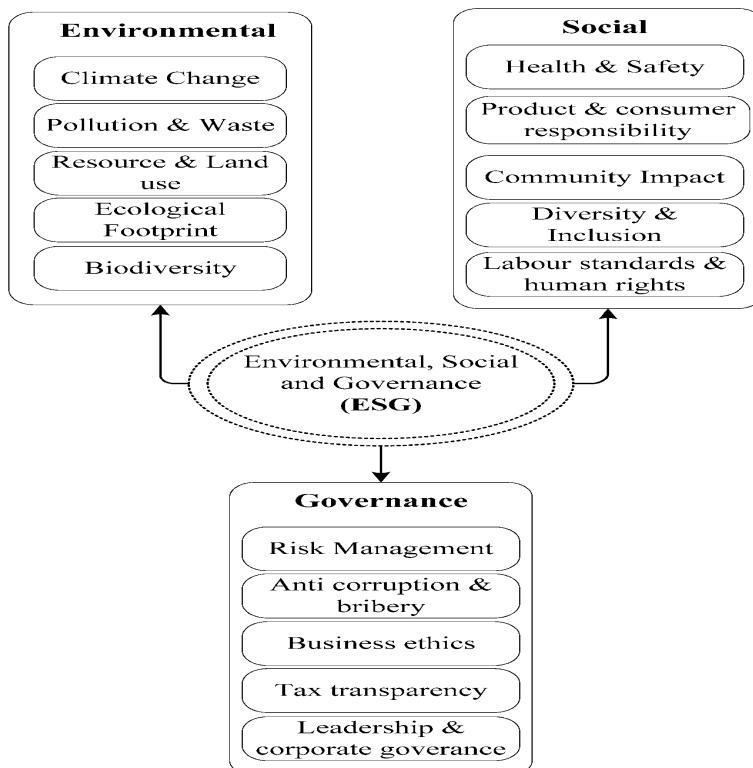


Figure 2.1: Elements of Environment, Social & Governance

Therefore the interplay between sustainable supply chain practices and digital transformation has the potential to enhance sustainability and resource efficiency (Raihan Uddin and Mamunur Rashid, 2022), the potential to improve environmental and social impact within supply chains including the textile industry (Stadnicka and Litwin, 2019). So, digital technologies can contribute to the sustainability performance of SMEs.

Consequently, the integration of sustainability principles into digital business transformation strategies can help SMEs leverage digital technologies to drive sustainable practices and social impact (Aduaye-Odiete, 2025).

Meanwhile, ESG is “primarily a risk management and investment framework that seeks to evaluate financial risks that environmental, social and governance factors pose for a company’s value” adopting an ‘outside-in’ perspective, best described as an investor and company-centric framework which seeks to de-risk portfolios and increase the economic resilience of the company’s” (Karim et al., 2024).

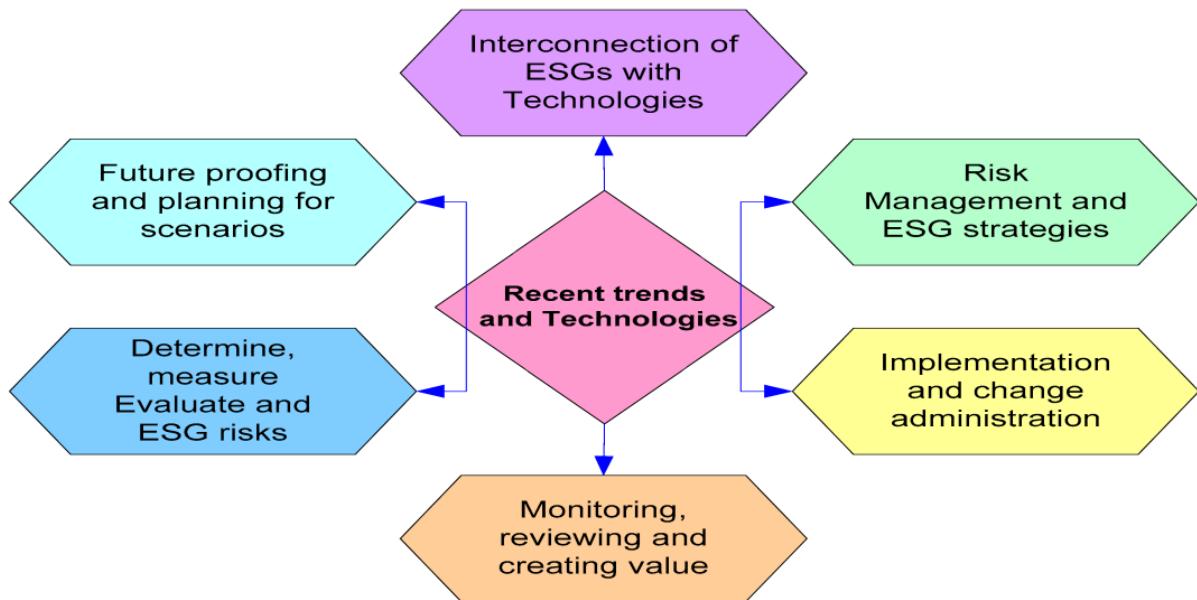


Figure 2.2: ESG Framework (Source: Saxena et al. 2023)

2.3 Synergies between digital and green practices

Digital and green strategies are often siloed, but synergies exist. Digital tools enhance resource efficiency through predictive analytics and IoT monitoring, while green initiatives align with consumer demand for sustainable products (OECD, 2022).

Although often treated in isolation, digital and green practices reinforce each other. Digital tools enable efficient energy management, predictive analytics, and ESG reporting. Meanwhile, green practices align with rising consumer demand for responsible products, creating new market niches. Emerging technologies such as AI and blockchain facilitate sustainable supply chain management and ESG transparency (Saxena et al., 2022).

So to build a sustainable future, firms would have to embrace ESG as a strong foundation, as it will help such firms deliver natural and positive outcomes and long term value. Therefore on sustainability, every aspect involving environmental, social and governance (ESG) should be considered and measured alongside financial considerations (Aduaye-Odiote, 2025).

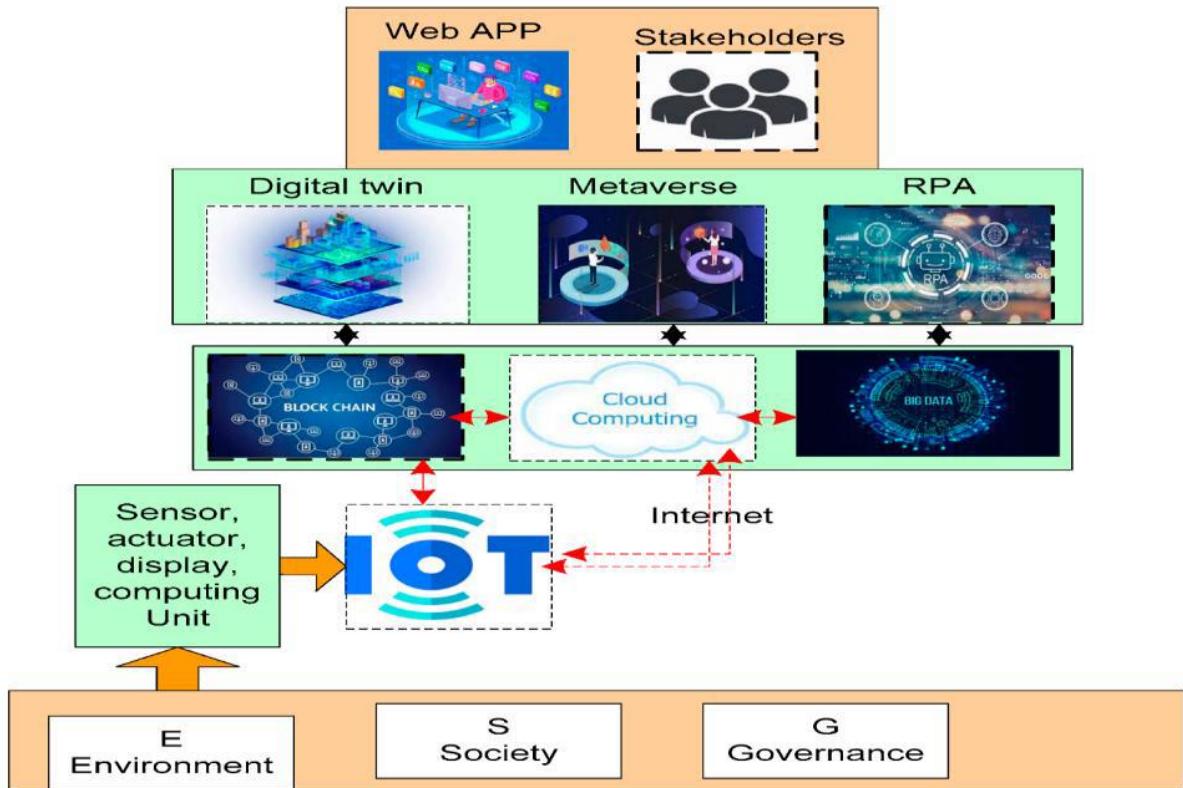


Figure 2.3: Emerging ESG Technology Phase (Source: Saxena et al. 2023).

While there could be challenges in ESG data and reporting, Industry 4.0 can overcome these challenges (Aduaye-Odiete, 2025). Artificial Intelligence (AI) for instance can provide a solution by acting as a catalyst for scaled sustainable analysis via technology analysis that filters important decisions as its framework serves as a driving force for humans to accelerate the necessary data in ESG metrics so that investors can understand which organization to invest. Also, blockchain allows firms to track sustainable efforts carried out with the intent of sustainability and implementation of the same kind of approach for ESG collection (Saxena et al., 2022).

Nigerian SMTEs that adopt both digital and green strategies are therefore better positioned to enhance resilience, competitiveness, and social equity.

3. Theoretical Frameworks

The study employs two theoretical lenses: the Technology-Organization-Environment (TOE) framework and the Resource-Based View (RBV) frameworks extended to incorporate sustainability metrics.

The TOE framework (Tornatzky and Fleischman, 1990) explains adoption through three dimensions: technological (e.g., perceived benefits), organisational (e.g., leadership support, IT capacity), and environmental (e.g., competitive pressures, regulatory frameworks). The theory therefore helps to explain the factors affecting SMTE readiness and capacity to adopt digital technologies within the broader emerging country business ecosystem.

The RBV (Barney, 1991) argues that firms achieve sustainable competitive advantage through unique resources that are valuable, rare, inimitable, and non-substitutable. Applying RBV to digital adoption, ERP systems and e-commerce platforms are viewed as strategic resources. When complemented by ESG practices, these resources enhance operational efficiency and financial performance. Combining

TOE and RBV allows a holistic analysis of external pressures and internal capabilities influencing digital-green convergence. Both theories therefore provide complementary perspectives for analysing integrated digital-green strategies.

4. Methodology

This research employed a mixed-methods approach to capture both measurable outcomes and contextual insights. A quantitative survey was distributed to 600 SMTEs in Lagos, yielding 400 valid responses. Structured questionnaires used Likert-scale items to assess levels of adoption, operational efficiency, financial performance, and ESG integration. Reliability was confirmed with Cronbach's alpha (>0.7). Regression analysis tested relationships between digital adoption, ESG practices, and performance outcomes.

Qualitative insights were gathered through 20 in-depth interviews with SME leaders and policymakers. Interviews explored perceptions of barriers, enablers, and strategies for integration. Thematic coding identified recurring themes such as cost barriers, skills shortages, and perceived value. Triangulation of quantitative and qualitative data ensured robustness and enriched interpretation. Ethical standards including informed consent, confidentiality, and anonymity were strictly observed.

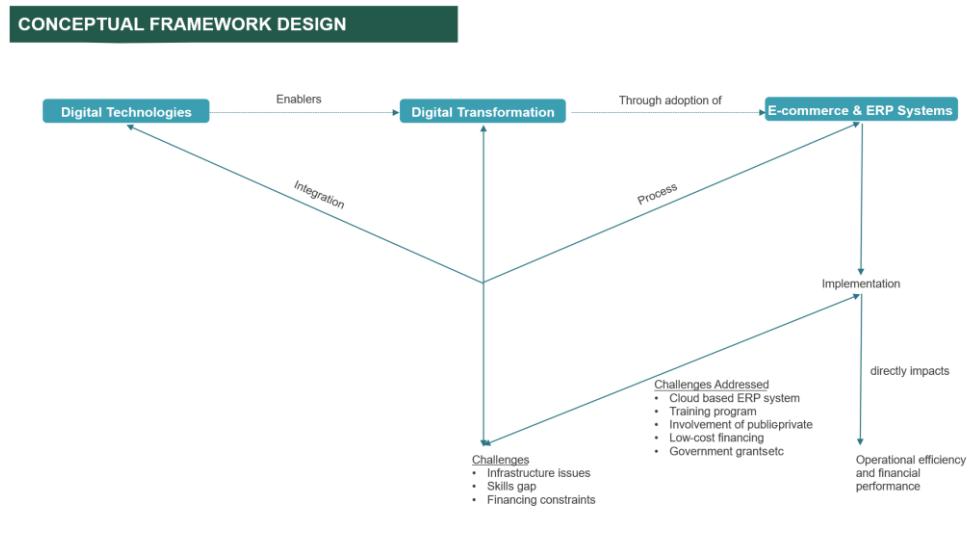
For instrumentation and variables, independent variables was adoption of digital technologies (e-commerce and ERP systems), while dependent variables is operational efficiencies and financial performance (measured through KPIs like increased sales, customer satisfaction, cost reduction, and revenue growth) and control variables is the size of enterprise, industry segment and IT capacity.

4.1 Research model

The conceptual model for this study and as illustrated below, showing the relationship between the independent and dependent variable, consequently how digital adoption and green practices influence performance outcomes.

Descriptive Statistics

Variable	Role in Model	Reference
Digital Technology Adoption	Independent Variable	Aduaye-Odiete (2025)
Green Practices (ESG)	Independent Variable	Saxena et al. (2023)
Operational Efficiency	Dependent Variable	Zhu et al. (2021)
Financial Performance	Dependent Variable	Alkhoraif et al. (2019)



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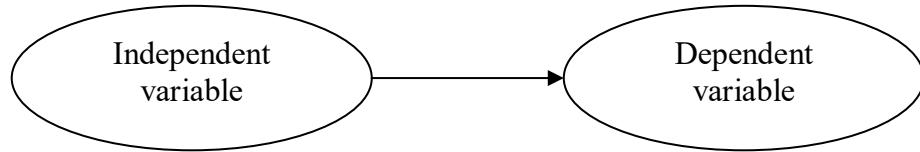


Figure 1: Research Model

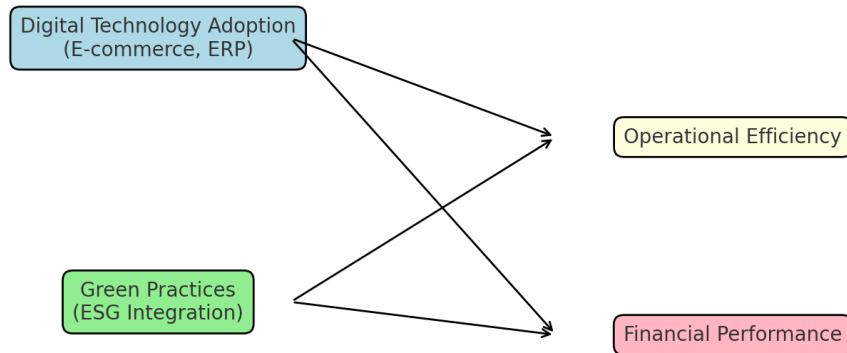
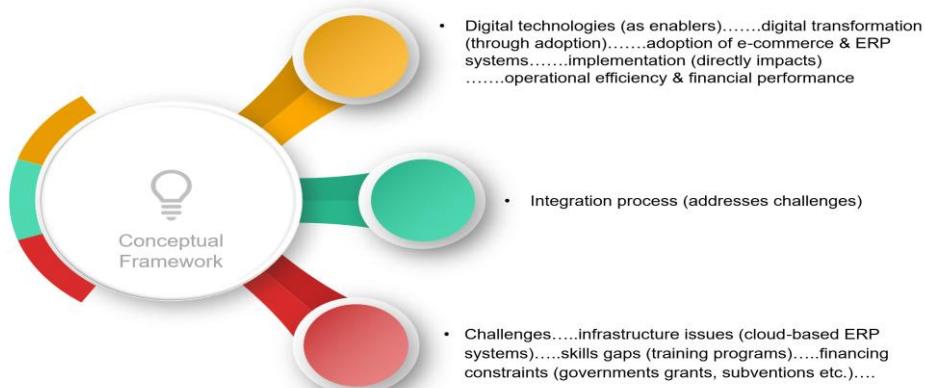


Figure 1. Research model showing independent and dependent variables

CONCEPTUAL FRAMEWORK DESIGN- 1



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Conceptual Framework Design

5. Results and Discussion

5.1 Regression analysis

Regression analysis results indicate a significant positive relationship between integrated adoption of digital green strategies and both operational efficiency and financial performance. Thus the result revealed significant positive effects of digital adoption ($\beta = 0.42$, $p < 0.01$) and green practices ($\beta = 0.36$, $p < 0.05$) on operational efficiency. Similarly, both factors positively influenced financial performance ($\beta = 0.47$, $p < 0.01$ and $\beta = 0.39$, $p < 0.05$ respectively). The model explained 62% of the variance in performance outcomes ($R^2 = 0.62$). ESG practices also positively influenced financial performance ($\beta=0.36$, $p<0.05$). Integrated adopters—firms implementing both digital and green practices—consistently outperformed partial adopters across KPIs such as sales growth, customer satisfaction, and compliance with ESG standards.

DATA ANALYSIS (1/2)

Correlation Analysis

1. Calculate correlation co-efficient between:

Adoption of digital technologies and each performance indicators

E-commerce adoption and revenue growth, cost reduction, market expansion, increased sales, customer engagement and satisfaction, return on sales, return on assets and profitability ratios

*Generate descriptive statistics such as mean, standard deviation, frequencies and percentages.

2. Repeat same for ERP systems

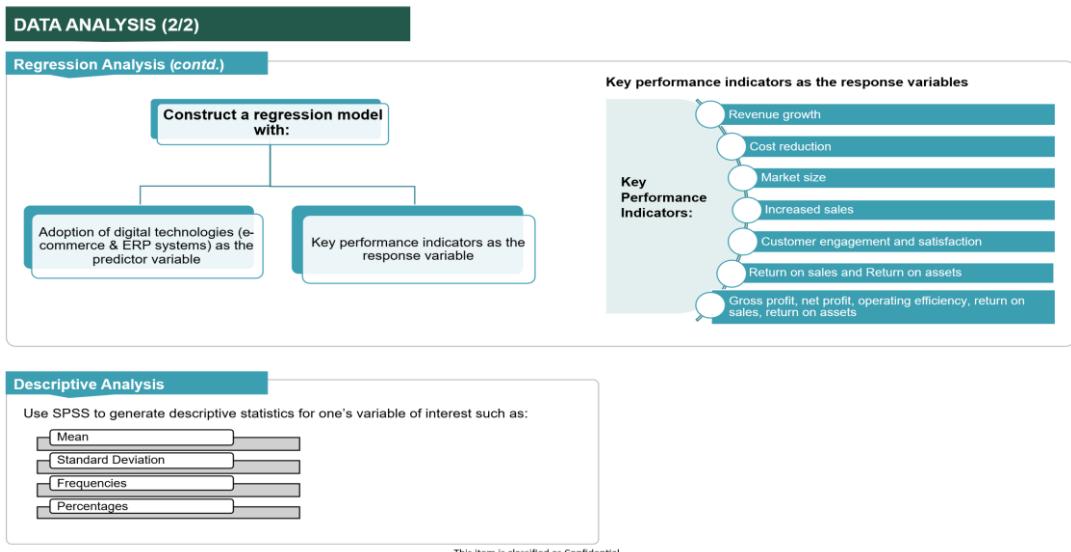
Regression Analysis

Regression analysis is to determine the relationships between:

The adoption of digital technologies (Independent variable or predictor variable)

Sustainable financial growth (dependent variable or outcome variable) measured by the performance indicators.

This item is classified as Confidential



5.2 Correleration analysis

Pearson correlation coefficient was used to measure the strength and direction of the relationships between two variables, adoption rates and factors like cost, technical expertise, and perceived benefits.

Correlation analysis highlighted cost as a major barrier (negative correlation with adoption), while technical expertise and perceived benefits correlated positively with adoption. These findings align with TOE assumptions that adoption is shaped by technological, organisational, and environmental factors. Qualitative data reinforced these results, with SMEs reporting difficulties in financing ERP systems and ESG investments, but recognising reputational and efficiency gains.

5.3 Comparative insights

Integrated adopters consistently outperformed partial adopters across all KPIs including in sales growth, customer satisfaction, and ESG compliance, underscoring the value of convergence. This supports global findings (Philbin et al., 2022) and highlights the potential of convergence to drive resilience and competitiveness in Nigerian SMTEs.

For the research and data collected, gender distribution was 55.8% male and 43.5% female, therefore shows a slightly higher male participation in the survey. Meanwhile, digital technologies adoption reveals a mean of 3.57, standard deviation of 4.28, and reliability (Cronbach Alpha) of 0.886, the high reliability of the data (Cronbach's Alpha – 0.886) suggests that the findings are consistent and dependable).

Further, the survey results revealed a moderate adoption rate of e-commerce of 46.5% and a low adoption rate of ERP systems of 44% among SMTEs in Lagos Nigeria, which therefore indicates significant room for improvement

6. Policy and Managerial Implications

The findings suggest three key implications.

For policymakers, the findings highlight the need for enabling ecosystems. Governments should provide financial incentives such as tax rebates for ERP-ESG integration, subsidies for renewable energy, and grants for digital adoption. Regulatory frameworks should mandate ESG disclosure while providing technical support for SMEs.

For managers, phased adoption is recommended. Firms can start with low-cost digitalisation (e.g., e-commerce), build digital maturity, and then integrate ERP systems and ESG practices. Capacity-building in digital skills and sustainability literacy is critical. Industry associations should coordinate training and knowledge-sharing workshops.

For investors and financial institutions, integrating digital-green metrics into credit assessments can incentivise adoption. SMEs that demonstrate convergence should be rewarded with preferential financing terms, as their long-term resilience reduces credit risk.

7. Conclusion

This study demonstrates that digital transformation and green economy integration serve as dual engines for sustainable growth, resilience, and equity in emerging markets. In Nigeria's SMTEs, co-adoption of e-commerce, ERP systems, and ESG practices improves operational and financial outcomes while addressing social and environmental challenges. The study validates the relevance of TOE and RBV frameworks in analysing integrated adoption and outcomes from the perspective of understanding digital transformation within resource-constrained SMTE environment. So the two defining forces of the 21st century which is the digital transformation of economies and the global push for sustainability through green economic models.

These dual shifts are not only driving innovation but also reshaping how nations approach economic policy, social equity programs, and long-term resilience. In particular, emerging markets such as 'nigeria provide fertile ground to explore the integration of digital technologies (e.g e-commerce and ERP systems) and green practices within small and medium -sized enterprises as engines of sustainable development.

Consequently can help to strengthen competitiveness of corporates by embracing digital technologies to streamline operations, reduce costs and boost revenue generation, while challenges such as cost constraints, lack of technical expertise and inadequate digital infrastructures must be addressed for effective adoption and implementation.

So this study details a demonstration of how digital transformation and ESG alignment can jointly boost resilience, competitiveness and social inclusion, providing an actionable insight into international development agencies, multilateral banks and SME policy makers frameworks for digital and sustainable transitions in developing regions.

Moreso, a paper that would serve as a model for integrating DBA research into global economic development discourse.

Future research should explore cross-sector comparisons, longitudinal studies, and the role of frontier technologies such as AI and blockchain in advancing digital-green convergence.

References

Aduaye-Odiete, P.O. (2025) 'Digital Transformation in Small and Medium-Sized Textile Enterprises (SMTEs) in Lagos, Nigeria: Assessing the Adoption of E-Commerce and ERP Systems for Operational Efficiency and Financial Performance'. DBA Thesis, Swiss School of Business and Management, Geneva

Albar, A.M. and Hoque, M.R. (2019) 'Factors affecting cloud ERP adoption in Saudi Arabia: An empirical study'. *Information Development*, 35(1), pp. 150-164

Alkhoraif, A., Rashid, H. and McLaughlin, P. (2019) 'Lean manufacturing and environmental management integration in SMEs', *Journal of Cleaner Production*, 223, pp. 632-644

Bharadwaj, A., El Sawy, O.A., Pavlou, P.A. and Venkatraman, N. (2013) 'Digital business strategy:Toward a next generation of insights. *MIS Quarterly*, 37(92), pp. 471-482

Calvino, F. and Criscuolo, C. (2019) 'Business dynamics and digital transformation: Policy evidence from OECD countries', *OECD Science, Technology and Industry Working Papers*, No. 2019/02, OECD Publishing, Paris

Ghobakloo, M. and Tang, S.H. (2021) 'Information system success among manufacturing SMEs: case of developing countries'. *Information Technology for Development*, 27(2), pp. 353-380.

Karim, M.R. et al. (2024) 'Analyzing the factors influencing sustainable supply chain management in the textile sector', *Cleaner Logistics and Supply Chain*, 13, p. 100183. Available at: <https://doi.org/10.1016/j.clsn.2024.100183>.

Organisation for Economic Co-operation and Development (OECD) (2022) *OECD SME and Entrepreneurship Outlook 2022*. Paris: OECD Publishing.

Philbin, S.P., Viswanathan, V. and Telukdaries, A. (2022) 'Digitalisation and sustainability: A systems thinking view in African industrial clusters', *International Journal of Sustainable Economy*, 14(1), pp. 22-39.

Saxena, A., Asokan, A.J. and Kwak, D. (2023) 'Emerging ESG technologies and frameworks: The integration challenge', *Sustainability Science & Policy*, 19(2), pp. 157-172.

Stadnicka, D. and Litwin, P. (2019) 'Value stream mapping and system dynamics integration for manufacturing line modelling and analysis', *International Journal of Production Economics*, 208, pp. 400-411. Available at: <https://doi.org/10.1016/j.ijpe.2018.12.011>.

Tornatzky, L.G. and Fleischer, M. (1990) *The Processes of Technological Innovation*. Lexington, MA: Lexington Books.

World Bank (2024) *World Development Report 2024: Data for Better Lives*. Washington, DC: World Bank

World Economic Forum (WEF) (2023) *Global Risks Report 2023*. Geneva: World Economic Forum.

Zhu, X., Shang, H., Dai, Z. and Liu, B. (2021) 'The impact of e-commerce sales on capacity utilization', *Engineering Economics*, 32(5). Available at: <https://doi.org/10.5755/j01.ee.32.5.28508>