CEDS Journal of Entrepreneurship and Innovation Research
Vol. 5 No. 1, June, 2026

EFFECT OF DIGITALISATION ON EXPORT OF MANUFACTURING GOODS IN NIGERIA

[1] Illah Barnabas Obaje*, [2]Ayodeji Salihu, [3]Alfa Yakubu, & [4]Chris Egwaikhide
***Corresponding authors' email**: illahobaje89@gmail.com

[1-4] Department of Economics, Nigerian Defence Academy, Kaduna – Nigeria

ABSTRACT

Digitalization has increasingly transformed global trade by improving communication, market access, production efficiency, and competitiveness in manufacturing exports worldwide. This study examines the impact of digitalization on the export of manufacturing goods in Nigeria over a period of between 1990 and 2024. Data for the study were collected form the World Development Indicator (2024), and were analyzed using the Autoregressive Distributed Lag (ARDL) model. Result ARDL F-bound test confirm a long-run relationship among the variables of the study. The result of long run ARDL model shows that mobile phone usage and GDP has significant positive effect on manufacturing exports, while internet penetration shows a positive but insignificant effect on manufacturing exports. Short-run dynamics reveal that the error correction term is negative and significant, indicating rapid adjustment to long-run equilibrium. Consequently, the study recommends targeted digital infrastructure investment and integration of digital tools into industrial strategies to enhance Nigeria's global competitiveness.

Keywords*:* Digitalization Manufacturing Export Internet Penetration Mobile Phone Usage Economic Growth
JEL Classification Code: *F14, O14, O33, L86, C22*

1.0 Introduction

Digitalisation has emerged as a defining characteristic of the 21st-century global economy. It is revolutionising the production, marketing, and distribution of goods and services across international boundaries. The growing utilisation of digital technologies, including internet platforms, mobile applications, automation, cloud computing, and data analytics, has transformed global trade, lowered transaction costs, and improved competitiveness in both developed and developing economies. Through real-time communication, efficient logistics management, and data-driven decision-making, digitalisation supports firms' participation in international markets and enables them to meet global standards (United Nations Conference on Trade and Development [UNCTAD], 2023).

Digitalisation serves as a major driver of export performance by reducing information barriers, improving productivity, and expanding market access. For manufacturing firms, digital tools such as e-commerce platforms, online marketing channels, and digital payment systems make export processes faster and more transparent. The magnitude of these advantages differs among countries based on digital infrastructure, human capital development, institutional quality, and macroeconomic factors.

The usage of digital technology in Nigeria has been increasing, however it remains inconsistent. The Nigerian Communications Commission (NCC, 2024) reports that internet penetration attained approximately 55 percent in 2024, attributed to the increasing number of mobile broadband and smartphone utilisation. Notwithstanding this advancement,

significant disparities persist regarding network availability, internet quality, and pricing, particularly in rural and industrial regions where the majority of manufacturing enterprises are situated. Additional issues encompass inconsistent power supply, elevated data expenses, insufficient infrastructure investment, and regulatory postponements. These limitations impede the comprehensive integration of digital tools in Nigeria's manufacturing and export operations.

Internet penetration, a significant measure of digital connection, is essential for enhancing export performance. Internet access enables enterprises to acquire market intelligence, engage directly with international purchasers, oversee supply chains digitally, and diminish reliance on intermediaries. The internet also supports e-commerce systems that simplify export documentation, communication, and payments, which increases efficiency and transparency in trade transactions. Similarly, mobile phone usage plays an important role in promoting trade and business operations in developing economies. Beyond simple communication, mobile phones support mobile banking, logistics tracking, and marketing activities. The swift increase in mobile phone ownership in Nigeria has facilitated financial inclusion, augmented access to market information, and elevated productivity among small and medium-sized firms. Mobile applications enable enterprises to engage with suppliers and consumers instantaneously, minimising delays and enhancing production efficiency.

Gross Domestic Product (GDP) also influences export performance by providing the macroeconomic environment that supports production and trade. A growing GDP often reflects higher levels of investment, improved infrastructure, and greater domestic demand, all of which encourage manufacturing activities and digital adoption. On the other hand, weak economic growth can limit investment in digital infrastructure and reduce the purchasing power required for technology acquisition. Consequently, GDP not only reflects overall economic success but also facilitates the relationship between digitisation and export growth.

The relationship among internet penetration, mobile phone usage, and GDP is crucial for comprehending Nigeria's manufacturing export performance. Digital connectivity improves efficiency and market access; yet, its efficacy is contingent upon a stable macroeconomic landscape. Digitalisation, when bolstered by consistent economic growth, fosters innovation, draws investment, and incorporates manufacturing enterprises into regional and worldwide value chains. Nonetheless, without robust economic fundamentals, the advantages of digitalisation may be constrained.

While several previous studies have investigated the relationship between digitalisation and trade performance, the majority have been focused on advanced economies or aggregate trade flows (UNCTAD, 2023). Despite its significance for industrialisation, employment generation, and foreign exchange diversification, only a limited number of studies have investigated this link within Nigeria's manufacturing sector. Comprehending the impact of digitalisation on the export of manufactured goods is essential for policy development and sustained economic advancement.

This study examines the impact of digitisation on the export of manufactured goods in Nigeria from 1990 to 2024. The Autoregressive Distributed Lag (ARDL) model is utilised to analyse the short-run and long-run impacts of internet penetration, mobile phone usage, and GDP on manufacturing exports. The results are anticipated to offer valuable guidance for policymakers on enhancing digital infrastructure, minimising obstacles to technology adoption, and aligning Nigeria's digital transformation with its objectives for export diversification and industrial development. The rest of the paper is structured as follows;

Section 2 is the literature review, Section 3; methodology, Section 4; discussion of findings while Section 5 concludes the paper.

2.0 Literature Review

2.1 Conceptual Review

Digitalization

Digitalisation, according to UNCTAD (2023), entails the incorporation of digital technologies into economic and social activities, transforming production, distribution, and consumption processes. Adeleye and Eboagu (2019) characterise it within the African context as the utilisation of ICTs, specifically internet and mobile connectivity, to improve performance, facilitate commerce, and assimilate economies into global markets. Qiang, Rossotto, and Kimura (2009) similarly consider broadband penetration and ICT usage as essential indicators, highlighting their function in reducing transaction costs, enhancing efficiency, and broadening market access. Consequently, internet prevalence and mobile phone usage serve as prevalent indicators of digitalisation, since they enhance information accessibility, lower expenses, and facilitate communication in international trade (Qiang et al., 2009; Adeleye & Eboagu, 2019; Prasad et al., 2024; UNCTAD, 2023).

Internet Penetration

Internet penetration refers to the extent of use of the internet in a country, and their study shows that income, telephone density, legal quality and human capital are key determinants of cross-country differences in internet use (Menzie D. Chinn & Robert W. Fairlie, 2006). Similarly, Jonas Hjort & Lin Tian (2021) characterize internet connectivity as part of digital infrastructure that allows firms, workers and consumers in developing countries to connect domestically and globally, affecting productivity, trade and growth. In the context of this study, internet penetration can be conceptually defined as the proportion of the population (or manufacturing firms) that have reliable access to the internet, which affects their ability to gather market intelligence, connect to foreign buyers, and participate in international manufacturing value-chains.

Mobile Phone Usage

Hjort and Tian (2021) defined mobile usage as part of a broader digital connectivity infrastructure that enables firms and individuals to participate more effectively in economic and trade activities, particularly in developing countries where fixed-line infrastructure is limited. While Aker and Mbiti (2010) described mobile phone usage as the adoption and use of mobile telephony by individuals and firms to communicate, exchange information, and facilitate market transactions. Furthermore, Donner (2008) explains mobile phone usage as the extent to which people employ mobile devices for everyday communication and economic activities. However, within the context of this study, mobile phone usage captures the degree to which Nigerian manufacturers and the wider population depend on mobile technology for production coordination, communication, logistics, and marketing, all of which can directly or indirectly influence export performance.

Gross Domestic Product

According to the World Bank (2023), GDP can be defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products, measured in current U.S. dollars. Similarly, Mankiw (2021) describes GDP as the market value of all final goods and services produced within a country in a given period of time. It measures both the total income of everyone in the

economy and the total expenditure on the economy's output of goods and services. Furthermore, Todaro and Smith (2015) defined GDP as the sum of value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.

Manufacturing Export

According to the United Nations Industrial Development Organization (UNIDO, 2022), manufacturing exports is the portion of manufacturing output that is sold to external markets, reflecting a country's industrial competitiveness and integration into global value chains. While Krugman and Obstfeld (2009), viewed manufacturing exports as the sale of domestically manufactured goods to foreign buyers for use, resale, or further processing abroad. Therefore, manufacturing export in the context of this study refers to the value of goods produced within Nigeria's manufacturing sector and sold to foreign markets. They serve as an important indicator of industrial development, export diversification, and competitiveness. Manufacturing exports, as a subset of total exports, reflect industrial maturity and integration into global value chains. In Nigeria, the interaction between digitalisation, GDP growth, and demographic dynamics underscores the potential of digital adoption to strengthen industrial exports and drive broader economic development. This makes internet and mobile technologies, alongside GDP, a robust framework for analysing their effect on Nigeria's manufacturing export performance between 1990 and 2024.

2.2 Theoretical Framework

This study is anchored on the Digital Transformation Theory proposed by Vial (2019). The proponent argued that digitalization is not merely about adopting new technologies but involves a holistic transformation of business processes, models, and value creation structures. It explains how organizations leverage digital tools such as the internet, mobile technologies, automation, and data analytics to enhance efficiency, competitiveness, and market access (Adeleye & Eboagu, 2019; Lastauskaite & Krusinskas, 2023). The theory captures the multidimensional relationship between digitalization and manufacturing export performance in Nigeria. Thus, the theory integrates the economic, organizational, and technological perspectives needed to explain how digital adoption through internet penetration and mobile phone usage enhances productivity, trade efficiency, and global competitiveness.

2.3 Empirical Review

Recent empirical studies have continued to highlight the transformative role of digitalization in driving trade and export performance across various economies.

According to Dumor et al. (2024), who applied a structural gravity model to 65 Belt and Road countries, ICT infrastructure significantly enhanced export volumes and GDP growth, particularly in East Africa. The study emphasized that targeted ICT investments are crucial for achieving sustainable, trade-driven growth. Similarly, Fahlevi et al. (2024) examined the impact of ICT on Pakistan's trade with 12 nations using various panel estimators and found that ICT development consistently boosted both imports and exports. In the same vein, Kanwal et al. (2024) investigated the impact of digital transformation on exports in Pakistan using annual time series data from 1990 to 2020 and the Autoregressive Distributed Lag (ARDL) model. Their findings revealed that digital transformation proxied by internet usage, mobile cellular subscriptions, and fixed telephone lines had a positive and significant impact on export performance.

Furthermore, Azu et al. (2024) explored the joint effects of ICT and BRICS membership on South Africa's trade over a 27-year period using an augmented gravity model. The results showed that mobile and fixed telephony positively influenced trade, while internet access had a dampening effect, suggesting the need for improved digital infrastructure quality. Zhang et al. (2024), using complex network analysis on ICT services trade from 2004 to 2020, found that digital trade advantages are concentrated among developed economies such as the United States and the United Kingdom. This indicates that peripheral economies require strategic digital alliances to enhance their participation in global markets.

In a similar context, Kere and Zongo (2023) examined intra-African trade using the Poisson Pseudo-Maximum Likelihood (PPML) estimator and found that broadband expansion reduces trade barriers and fosters regional integration. Likewise, Billon, Rodríguez-Andrés, and Rodríguez-Crespo (2023), through a cross-country analysis also employing PPML estimators, confirmed that broadband facilitates communication, closes trade information gaps, and enhances intra-African trade efficiency. González et al. (2023), in their assessment of the macroeconomic role of ICT in trade using OECD data, revealed that digital trade accounted for approximately 24% of global trade by 2018 and that digital clauses in trade agreements significantly enhanced export performance.

Similarly, Soylu et al. (2022) analyzed Eastern and Western European economies using Bootstrap Ordinary Least Squares (BOLS) and Method of Moments Quantile Regression (MM-QR). Their results showed that both mobile and fixed-line usage, particularly mobile penetration, enhanced competitiveness when combined with greater trade openness. Abendin, Duan, and Nkukpornu (2022) also reported comparable results in West Africa, showing through a gravity model that digitization significantly improves trade flows by reducing transaction barriers and enhancing trade efficiency. Furthermore, Özsoy et al. (2022), using gravity models and PPML estimators, demonstrated that ICT investment plays a vital role in promoting high-tech exports and improving developing countries' participation in global markets.

Azu and Nwauko (2021) conducted a panel ARDL study on West Africa's service exports and confirmed a strong positive relationship between ICT and trade performance in both the short and long run. The authors recommended that regional policymakers strengthen digital integration strategies to sustain export growth and competitiveness. Similarly, Rodríguez-Crespo et al. (2021), through cross-country and bilateral trade analyses using gravity models with PPML estimators, found that broadband and mobile internet enhance trade, though with varying effects across countries, reinforcing the need for technology-specific policy interventions.

Despite the expanding literature highlighting the beneficial effects of digitalisation on commerce and exports in various countries, significant discrepancies persist. Most previous studies have focused on aggregated trade flows or cross-country analyses, with minimal emphasis on sector-specific exports, such as manufacturing. Moreover, although numerous studies (e.g., Dumor et al., 2024; Fahlevi et al., 2024; Kanwal et al., 2024) have utilised models such as the gravity and PPML estimators to evaluate the effects of digitalisation, few have specifically applied the ARDL framework to analyse both short- and long-term impacts within a singular economy. Furthermore, empirical data from Nigeria is limited, especially regarding the interaction of critical digitalisation factors such as internet access, mobile phone usage, and GDP in affecting industrial export performance. This study addresses this gap by employing the ARDL methodology to analyse the impact of digitalisation on the export of manufactured goods in Nigeria, offering country-specific insights and policy recommendations for enhancing export competitiveness through digital infrastructure.

3.0 Methodology

3.1 Model Specification

The model for this study is adapted from Kanwal et al. (2024), who examined the impact of digital transformation on exports in Pakistan using the Autoregressive Distributed Lag (ARDL) approach. The present study modifies their framework to suit the Nigerian context by focusing on the manufacturing export sector and incorporating key indicators of digitalization such as internet penetration rate, mobile telephone usage, and gross domestic product (GDP).

The functional relationship among the variables is expressed as:

$$MFG = f\left(INT, MOB, GDP\right) \tag{1}$$

Where:

MFG= "Manufacturing exports (proxy for export performance)
INT= Internet penetration rate
MOB= Mobile telephone subscriptions
GDP= Gross Domestic Product
t = Time period

The log-linearized form of the long-run model is presented as:

$$\ln MFG_t = \beta_0 + \beta_1 \ln INT_t + \beta_2 \ln MOB_t + \beta_3 \ln GDP_t + \mu_t \tag{2}$$

Where;

β_0= Constant term
β_1- β_3 = Parameters to be estimated
μ_t = Error term

In this study, trade refers to manufacturing exports (MFG), while digitalization is measured by internet penetration (INT) and mobile phone usage (MOB), expressed as population percentages. Real GDP (GDP) captures market size and economic capacity. Literature suggests digitalization reduces trade costs, improves efficiency, and enhances global market access. By facilitating communication, transactions, and supply chains, internet and mobile adoption lower barriers like information asymmetry and delays. Thus, this study hypothesizes a positive link between digital adoption and Nigeria's manufacturing export performance.

Table 1: Data sources and Expected Signs of Coefficients

Variable	Apriori	Source
Manufactured Export (MFG_t)	Dependent	World Development Indicator (WDI)
Internet Penetration Rate (INT)	Positive (+)	World Development Indicator (WDI)
Mobile Telephone (MOB_t)	Positive (+)	World Development Indicator (WDI)
GDP constant (GDP_t)	Positive (+)	World Development Indicator (WDI)

Source: Constructed by the Author (2024)

3.2 Estimation Technique (ARDL Model Specification)

To account for both short-run and long-run relationships among the variables, this study employs the Autoregressive Distributed Lag (ARDL) model developed by Pesaran, Shin, and Smith (2001). The ARDL model is suitable for variables integrated of order I(0) or I(1), and is efficient for small sample sizes. Therefore, equation (2) could be altered to the broad form of the Autoregressive Distributed Lag (ARDL) Model. The long-run form of the model can be specified as:

$$\Delta \ln MFG_t = \beta_0 + \sum_{i=0}^{p} \beta_1 \Delta \ln MFG_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln INT_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln MOB_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta \ln GDP_{t-i} + \mu_t \quad 3$$

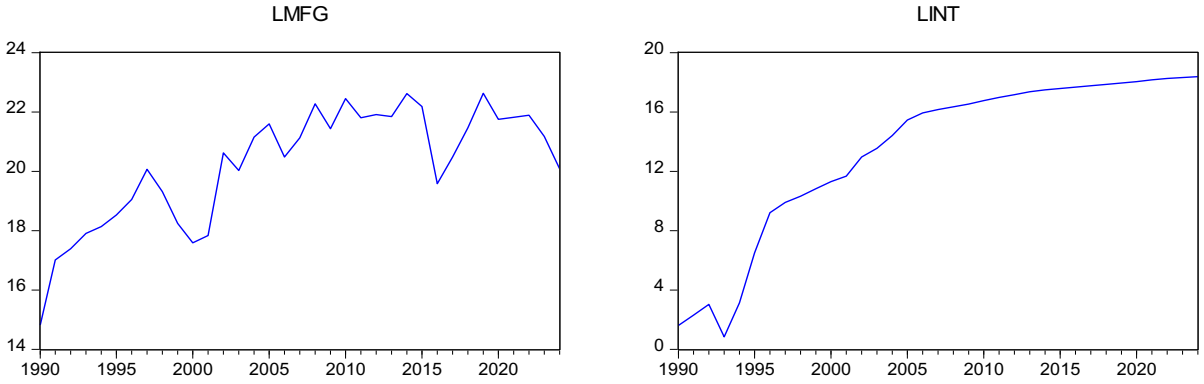
The parameter β_0 and μ_t represent the intercept and disturbance error term, t= time, Σ is summation sign, ln is the natural log transformation and Δ is the difference operator respectively. Equation (3) test the null hypothesis $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ there is no cointegrating relationship between the variables against the alternative of cointegration using the bound testing procedure to test long-run relationship of the model. However, in order to measure the speed of adjustment from the short run dynamic to longrun equilibrium, the short-run model is specified by also including the error correction term as follows:

$$\Delta \ln MFG_t = \beta_0 + \sum_{i=0}^{p} \beta_1 \Delta \ln MFG_{t-i} + \sum_{i=0}^{p} \beta_2 \Delta \ln INT_{t-i} + \sum_{i=0}^{p} \beta_3 \Delta \ln MOB_{t-i} + \sum_{i=0}^{p} \beta_4 \Delta \ln GDP_{t-i} + \lambda ECT_{t-1} + \mu_t \quad 4$$

Where λ is the coefficient of the error correction term which measures the speed of adjustment from the short-run dynamics to the long-run equilibrium, ECT is the error correction term, and μt represent the error term. In theory, the coefficient λ is expected to be significant and negative for short-run convergence to take place.

4.0 Results and Discussions

4.1 Result of Trend Analysis



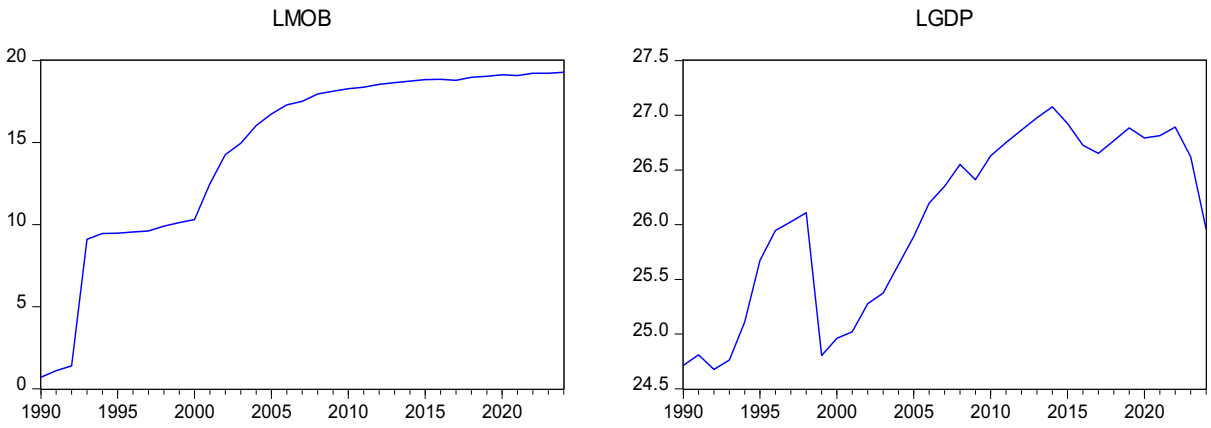


Figure 1: Trend of Manufacturing Export and Digitalization in Nigeria.

Sources: Source: Author's computation using E-views 10

The graphical analysis in Figure 1 highlights the relationship between digitalization and manufacturing exports in Nigeria from 1990 to 2024. Manufacturing exports (LMFG) recorded steady gains in the early 1990s, though this progress became unstable towards the end of the decade. From 2000 to around 2015, exports maintained higher but fluctuating levels, pointing to modest industrial progress. After 2015, however, exports weakened slightly despite rapid advances in digital technologies, suggesting that policy gaps and structural bottlenecks may have undermined potential gains from digitalization.

Internet penetration (LINT) rose sharply after the mid-1990s, accelerating in the early 2000s with improved ICT infrastructure. By 2010, penetration reached double-digit levels and continued to expand, though at a slower pace after 2015. Likewise, mobile phone usage (LMOB) grew dramatically after telecom sector liberalization in 2001, approaching saturation by 2015. Together, these trends reflect Nigeria's significant digital transformation over the period.

By contrast, real GDP (LGDP), included as a control, reveals the wider economic setting. Growth was sustained through the 2000s and early 2010s but slowed after 2015 due to oil price shocks and macroeconomic instability. This downturn coincides with weaker manufacturing export performance, showing that broader economic stability is necessary to unlock the benefits of digitalization. Therefore, digitalization, as measured by internet and mobile adoption, has provided an enabling platform for trade efficiency. Yet, the absence of consistent export growth highlights enduring challenges such as weak industrial capacity, inadequate infrastructure, and economic instability, which continue to hinder Nigeria's manufacturing export competitiveness.

Table 2: Result of Descriptive Statistics
Descriptive Statistics

Descriptive	LMFG	LINT	LMOB	LGDP
Mean	20.236	13.362	14.547	26.046
Median	20.619	16.155	17.514	26.198
Maximum	22.628	18.383	19.280	27.076
Minimum	14.816	0.838	0.693	24.676
Std. Dev.	1.936	5.569	5.608	0.801
Skewness	-0.818	-1.076	-1.173	-0.459
Kurtosis	2.945	2.831	3.366	1.745

Jarque-Bera	3.905	6.793	8.225	3.524
Probability	0.142	0.033	0.016	0.172
Sum	708.263	467.679	509.137	911.623
Sum Sq. Dev.	127.389	1054.438	1069.392	21.830
Observations	35	35	35	35

Source: Author's computation using E-views 10

Table 2 summarised the descriptive statistics for four logarithmically transformed variables over 35 time-series observations. The dependent variable, lnMFG (log of manufacturing exports), exhibits moderate variability with a mean of 20.236 and a standard deviation of 1.936, ranging from 14.816 to 22.628. In contrast, lnINT (log of internet penetration) and lnMOB (log of mobile phone usage) demonstrate substantial dispersion, with respective standard deviations of 5.569 and 5.608, and wide value ranges, reflecting the uneven and rapid diffusion of digital technologies. While lnGDP (log of gross domestic product) shows more stability, with a mean of 26.046 and a relatively low standard deviation of 0.801, indicating consistent output levels.

Table 3: Results of the ADF Unit Root Test

Variables	**ADF @ Level**	**ADF @ First Diff.**	**Remark**
lnMFG	-3.171117	-6.172855**	I(1)
lnINT	-4.051650**	----------	I(0)
lnMOB	-3.505784**	----------	I(0)
lnGDP	----------	-4.308958**	I(1)

Note: ** denotes stationarity order

Source: Author's computation using E-views 10

Table 3 displays the Augmented Dickey-Fuller (ADF) unit root test results, assessing the stationarity of model variables. At level, lnINT and lnMOB are stationary, as their test statistics exceed the 5% critical value, indicating they are I(0) variables. The other variables, lnMFG and lnGDP, exhibit non-stationarity, confirming the presence of unit roots and implying persistent trends. However, after first differencing, these non-stationary series attain stationarity, with lnMFG, significant at 5% level and lnGDP at the 1% level, establishing them as I(1) processes. With variables integrated at different orders, the Autoregressive Distributed Lag (ARDL) approach becomes appropriate, as it accommodates both I(0) and I(1) series in a unified framework.

Table 4: Result of F-Bounds Test

Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	8.265768	10%	2.97	3.74
K	3	5%	3.38	4.23
		2.5%	3.8	4.68
		1%	4.3	5.23

Source: Author's computation using E-views 10

4.2 Cointegration Tests

Table 4 reports the ARDL F-bounds test results, confirming the existence of a long-run relationship between manufacturing exports and explanatory variables, including digitalization indicators. The F-statistic of 8.266 exceeds the upper bounds at all conventional significance levels (10%, 5%, and 1%), leading to the rejection of the null hypothesis of no

cointegration. This signifies that internet penetration, mobile phone usage, and GDP jointly exert a long-term influence on manufacturing exports.

Table 5: Result of ARDL Long-run estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINT	0.074653	0.066084	1.129654	0.2689
LMOB	0.200466	0.072143	2.778748	0.0100
LGDP	1.051179	0.265710	3.956108	0.0005
@TREND	-0.051808	0.027818	-1.862389	0.0739

Source: Author's computation using E-views 10

The results in table 5 indicate that internet penetration has a positive insignificant relationship with manufacturing exports in the long-run. This confirmed the apriori expectation of LINT effect on manufacturing exports in Nigeria. The coefficient of internet penetration (LINT) is 0.074653 which implies that a percent increase in LINT will raise LMFG by approximately 0.075% holding other factors constant. The positive link between internet penetration and manufacturing exports reflects how digital access improves communication, market reach, and supply chain efficiency. This enables manufacturers to explore export opportunities, even though structural challenges may restrict the overall impact. The result supports the findings by (Duval & Utoktham, 2025: Dumor et al., 2024: Azu, Ehimare & Abdullahi 2025: Fahlevi et al., 2024: Abendin, Duan, & Nkukpornu's, 2022: Rodriguez-Crespo et al., 2021: Nwanko, 2021) who found internet penetration positive in their study.

Mobile phone usage (LMOB) impacted positively on manufacturing export in Nigeria. This is consistent apriori expectation. As reported in table 5, the estimated coefficient is 0.200466. This implies that all other factors being constant, a percent increase in mobile phone usage will raise manufacturing export (LMFG) by approximately 0.201%. The positive relationship between mobile phone usage and manufacturing exports arises because mobile technology improves business communication, market access, and coordination of supply chains. It enables manufacturers to connect with international buyers, access market information, and enhance efficiency, thereby supporting export growth. The result was significant at 1% with $p<0.01$. The result aligned with the findings by (Dumor et al., 2024: Azu: Fahlevi et al., 2024: Abendin, Duan, & Nkukpornu's, 2022: Azu et al. 2024, Rodriguez-Crespo et al., 2021: Soylu et al., 2022) who also found mobile phone usage positive in their study.

Similarly, findings from table 5 indicated that gross domestic product (LGDP) exert a positive impact on manufacturing export (LMFG) in the long-run with estimated coefficient of 1.051179. This indicates that other factors being constant, a percent rise in the GDP will cause an increase in manufacturing export by approximately 1.051% in the long-run. The implication is that growth in GDP stimulates higher manufacturing export performance, indicating that a stronger domestic economy enhances production capacity, competitiveness, and integration into global markets. The result was significant at 1% with $p<0.01$. This result is consistent with the apriori expectation and also aligns with the findings by (Dumor et al., 2024).

Table 6: Result of ARDL Short-run estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-11.58569	1.696681	-6.828445	0.0000
D(LMFG(-1))	0.331961	0.122717	2.705093	0.0119
CointEq(-1)*	-1.126914	0.163189	-6.905586	0.0000

R-squared	0.615439	Mean dependent var	0.092971
Adjusted R-squared	0.589801	S.D. dependent var	0.995833
S.E. of regression	0.637799	Akaike info criterion	2.024920
Sum squared resid	12.20361	Schwarz criterion	2.160966
Log likelihood	-30.41118	Hannan-Quinn criter.	2.070695
F-statistic	24.00549	Durbin-Watson stat	2.270755
Prob(F-statistic)	0.000001		

Source: Author's computation using E-views 10

The results of the short-run in Table 6 indicate that the previous one year of manufacturing export D(LMFG(-1)) revealed a positive relationship with manufacturing export (LMFG). The coefficient is 0.33196. The result was significant at 1% with p<0.01. This imply that a percent increase in D(LMFG(-1)) will cause an increase of about 0.332% in the short-run. Thus, it is an indication that past growth in manufacturing exports encourages present growth. Lastly, the short-run estimate in table 6 shows that the slope coefficient of the error correction term (ECT (-1)) is negative and statistically significant at 1% level. The slope coefficient which is -1.126914 represents the speed of adjustment from short-run dynamics to the long-run equilibrium. This shows strong evidence of long-run equilibrium adjustment. About 113% of the disequilibrium from the previous period is corrected in the current period, meaning adjustment is quite fast.

Furthermore, the result from the table shows that 62% of variations in manufacturing export (LMFG) are explained by the changes in the explanatory variables (internet penetration, mobile phone usage and gross domestic product). The Durbin-Watson value of 2.271 indicates the absence of serial correlation in the model.

Table 7: Results of Post Estimation Diagnostic Tests

Test	F-statistics	Obs* R-squared	Probability
Serial Correlation	2.193	2.661	0.151
Heteroscedasticity	0.236	1.706	0.960
Jaque Bera	2.370	-	0.306
Ramsey RESET	1.376	-	0.252

Source: Author's computation using E-views 10

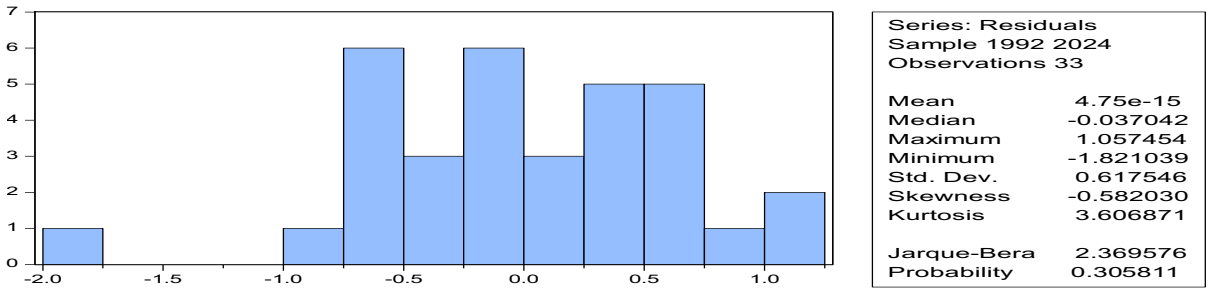


Figure 2: Normality test

Table 7 reveals the post estimation statistics in order to check whether the coefficients of the model have the potential for generating inference or not. The first test is the serial correlation LM test developed by Breusch and Godfrey (1978). The null hypothesis is that H0: there is no

serial correlation residual in the regression. The result from the table shows that p-value is 0.151 which is greater than 5% critical value. This suggests that the null hypothesis of absence of serial correlation cannot be rejected. Furthermore, the probability value for the heteroskedasticity test developed by White (1980) is 0.960, which is greater than 5% critical value, implying that the null hypothesis of no heteroskedasticity in the residuals cannot be rejected.

The Jaque Bera (Normality test) developed by Jaque and Bera (1980) to test for the normality distribution of the residuals. The null hypothesis H0: The residuals are normally distributed. The Jarque and Bera value is 0.306 which is greater than 0.05 level of significance, implying that the model is normally distributed. Lastly is the Ramsey RESET test developed by Ramsey (1969) for testing mis-specification of functional form. The null hypothesis of the test is that H0: The equation has no functional form misspecification. The result from the table shows that p-value is 0.252 which is greater than 5% critical value. This suggests that the model is well specified.

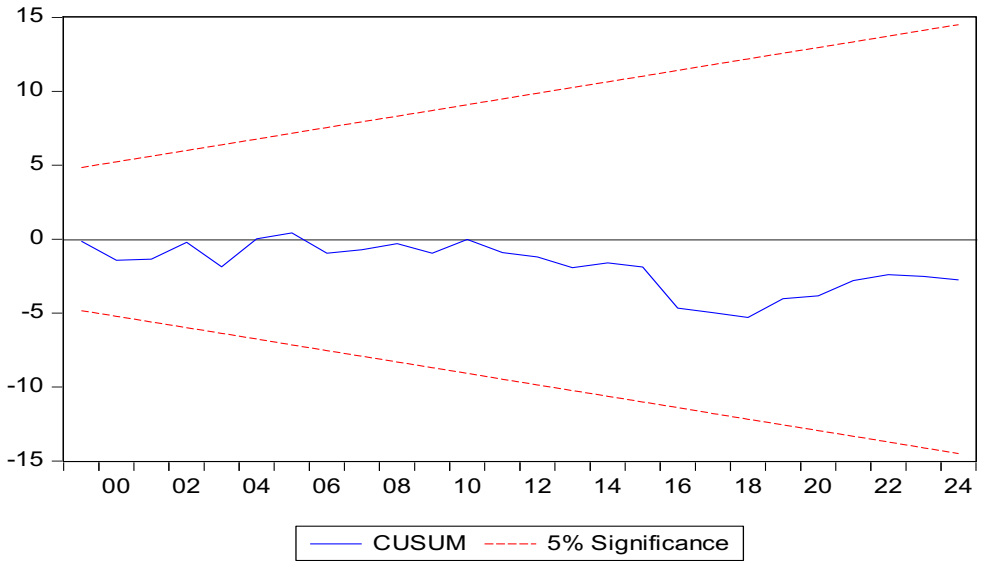


Figure 3: Cusum test

The Cusum for stability tests are presented in figure 2. In the graph, there is a thin blue line in between two red bands. If the blue line is within the two red bands, it means the model is stable otherwise unstable. From the figure below the lines are within the bands suggesting that the calculated model is stable and significant at 0.05 critical values."

5.0 Conclusion and Recommendations

The study concludes that although digitalization has progressed significantly in Nigeria, particularly through increased internet penetration and mobile phone usage, its influence on the export performance of manufacturing goods remains marginal and, in some instances, adverse. Trend analysis revealed a notable misalignment between the growth of digital infrastructure and the fluctuations in manufacturing exports. The absence of a coherent integration between digital tools and industrial production processes limits the capacity of digitalization to enhance trade outcomes. Moreover, empirical findings suggest that digitalization in its current form does not exert a meaningful impact on export performance in either the short or long term, indicating that technological expansion has not translated into structural industrial advancement.

This pattern undermines the transformative potential of digitalization as conceptualized in digital transformation theory. It also points to significant policy and implementation gaps, particularly in aligning digital initiatives with industrial competitiveness goals. Without a deliberate and integrated digital-industrial strategy, the benefits of digitalization are unlikely to materialize fully in terms of export growth, innovation, or industrial diversification. Future progress in manufacturing exports will require a systematic effort to embed digital tools into the heart of production, logistics, and market access strategies.

REFERENCE

Abendin, S., Duan, P., & Nkukpornu, E. (2022). Bilateral trade in West Africa: Does digitalisation matter? The International Trade Journal, 36(6), 477–501. https://doi.org/10.1080/08853908.2021.2015488

Adeleye, N., & Eboagu, C. (2019). Evaluation of ICT development and economic growth in Africa. NETNOMICS: Economic Research and Electronic Networking, 20(1), 31–53.

Adeleye, N., & Eboagu, C. (2022). Digital transformation in Africa: Challenges and policy recommendations. Digital Policy, Regulation and Governance, 24(1), 45–60. https://doi.org/10.1108/DPRG-05-2021-0067

Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. Journal of Economic Perspectives, 24(3), 207–232.

Azu, N. P., Adekalu, S. O., Isa, Y., & Chiadikobi, J. O. (2024). Evaluating the influence of information and communication technology and the BRICS in South African trade dynamics: A gravity model approach. Journal of International Trade Law and Policy, 23(2–3), 168–186. https://doi.org/10.1108/JITLP-07-2024-0045

Azu, N. P., & Nwauko, P. A. (2021). Evaluating the effect of digital transformation on improvement of service trade in West Africa. Foreign Trade Review, 56(4), 430–453. https://doi.org/10.1177/00157325211032021

Banerjee, A., Dolado, J. J., Galbraith, J. W., & Hendry, D. (1993). Co-integration, error correction, and the econometric analysis of non-stationary data. Oxford University Press.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. MIS Quarterly, 37(2), 471–482. https://doi.org/10.25300/MISQ/2013/37:2.03

Billon, M., Rodríguez-Andrés, A., & Rodríguez-Crespo, E. (2023). Broadband use and trade facilitation: Impacts on bilateral trade of Sub-Saharan countries. African Development Review, 35(2), 113–125. https://doi.org/10.1111/1467-8268.1269

Brennen, J. S., & Kreiss, D. (2016). Digitalization. In The International Encyclopedia of Communication Theory and Philosophy (pp. 1–11). Wiley-Blackwell.

Chinn, M. D., & Fairlie, R. W. (2010). ICT use in the developing world: An analysis of differences in computer and internet penetration. Review of International Economics, 18(1), 153–167.

Chukwudi, N. (2024). Impact of digitalization on firm performance in the manufacturing sector: A case study of Nigeria. International Journal of Strategic Management, 3(1), 17–29. https://doi.org/10.47604/ijsm.2480

Coyle, D. (2017). GDP: A brief but affectionate history. The Quarterly Journal of Austrian Economics, 20(1), 97–103.

Donner, J. (2008). Research approaches to mobile use in the developing world: A review of the literature. The Information Society, 24(3), 140–159.

Dumor, K., Shurong, Z., Dumor, H. K., Ampaw, E. M., Amouzou, E. K., Okae-Adjei, S., & Boadi, E. K. (2024). Evaluating the effect of ICT on trade and economic growth from the perspective of Eastern African Belt and Road countries. Information Technology for Development, 30(3), 452–471.

Duval, Y., & Utoktham, C. (2025). Impact of trade facilitation on global agricultural trade: Evidence from a structural gravity model. UN ESCAP Working Paper Series.

Fahlevi, M., Asdullah, M. A., Raza, F. A., Watto, W. A., Aljuaid, M., & Aziz, A. L. (2024). The influence of information and communication technology on trade in developing countries and partners. Cogent Business & Management, 11(1), 2320814. https://doi.org/10.1080/23311975.2024.2320814

González, J. L., Sorescu, S., & Kaynak, P. (2023). Of bytes and trade: Quantifying the impact of digitalisation on trade. OECD Digital Trade Studies.

Govers, M., & Van Amelsvoort, P. (2023). A theoretical essay on socio-technical systems design thinking in the era of digital transformation. Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie (GIO), 54(1), 27–40.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37(3), 424–438.

Hjort, J., & Tian, L. (2021). The economic impact of internet connectivity in developing countries. Annual Review of Economics, 17(1), 1–28.

Kanwal, A., Ahmad, A., & Ilyas, M. (2024). Examining the impact of digital transformation on exports of Pakistan. Pakistan Social Sciences Review, 8(2), 360–373.

Kere, S., & Zongo, A. (2023). Digital technologies and intra-African trade. International Economics, 173, 359–383.

Krugman, P. R., & Obstfeld, M. (2009). International economics: Theory and policy (8th ed.). Pearson Education.

Lastauskaite, A., & Krusinskas, R. (2023). Digitalization and productivity: Evidence from EU manufacturing sector. European Journal of Economics, 3(1), 1–12.

Mankiw, N. G. (2018). Principles of economics (8th ed.). Cengage Learning.

Mishkin, F. S. (2016). The economics of money, banking, and financial markets (11th ed.). Pearson.

National Communications Commission (NCC). (2024). Annual Cybersecurity Report 2024. Abuja: NCC.

Nnanna, P. A., Aburime, E., & Abdullahi, H. P. (2025). ICT and trade competitiveness in West Africa: The mediating role of revealed comparative advantage in the non-alcoholic beverage sector. Future Business Journal, 11(1), 1–14.

Özsoy, S., Ergüzel, O. S., Ersoy, A. Y., & Saygılı, M. (2022). The impact of digitalisation on export of high technology products: A panel data approach. The Journal of International Trade & Economic Development, 31(2), 277–298. https://doi.org/10.1080/09638199.2021.1965645

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289–326.

Prasad, A., Subramani, K., Refass, S., Saidi, N., Salem, F., & Shepherd, B. (2024). Global Economic Diversification Index 2024: Exploring the impact of digital trade on economic diversification. World Government Summit Series.

Qiang, C. Z. W., Rossotto, C. M., & Kimura, K. (2009). Economic impacts of broadband. In Information and Communications for Development 2009: Extending Reach and Increasing Impact (pp. 35–50). World Bank.

Rodríguez-Crespo, E., & Martínez-Zarzoso, I. (2019). The effect of ICT on trade: Does product complexity matter? Telematics and Informatics, 41, 182–196. https://doi.org/10.1016/j.tele.2019.05.001

Rodríguez-Crespo, E., Marco, R., & Billon, M. (2021). ICTs impacts on trade: A comparative dynamic analysis for Internet, mobile phones, and broadband. Asia-Pacific Journal of Accounting & Economics, 28(5), 577–591. https://doi.org/10.1080/16081625.2018.1519636

Roger, M., Shulin, L., & Sesay, B. (2022). ICT development, innovation diffusion and sustainable growth in sub-Saharan Africa. SAGE Open, 12(4), 21582440221123894.

Shittu, A. I. (2012). Financial intermediation and economic growth in Nigeria. British Journal of Arts and Social Sciences, 4(2), 164–179.

Todaro, M. P., & Smith, S. C. (2015). Economic development (12th ed.). Pearson Education Limited.

United Nations Conference on Trade and Development (UNCTAD). (2008). Information Economy Report 2007–2008: Science and technology for development—the new paradigm of ICT. United Nations. https://unctad.org/system/files/official-document/ecn162008d3_en.pdf

United Nations Conference on Trade and Development (UNCTAD). (2023). UNCTAD database.

United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP). (2023). Digital and sustainable trade facilitation: Global report 2023. https://hdl.handle.net/20.500.12870/7239

United Nations Industrial Development Organization (UNIDO). (2021). Industrial development report 2022: The future of industrialization in a post-pandemic world. https://www.unido.org/resources-publications

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Westerman, G., Bonnet, D., & McAfee, A. (2014). Leading digital: Turning technology into business transformation. Harvard Business Review Press.

World Bank. (2023). World development indicators: GDP (current US$). World Bank.

Zhang, Y., Xu, J., & Yang, W. (2024). Analysis of the evolution characteristics of international ICT services trade based on complex network. Telecommunications Policy, 48(3), 102697. https://doi.org/10.1016/j.telpol.2023.102697.