



Effect of Information Communication Technology on Credit Administration on Deposit Money Banks in Nigeria

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Abstract

Effective communication between the borrower and bank plays a pivotal role in reducing non-performing loans (NPLs) and ensuring the stability of the banking sector in Nigeria. Studies in this regard in the context of emerging financial system have received little attention particularly the Nigerian financial system. This study scrutinizes the effect of information and communication technology (ICT) on credit administration in Nigeria from 2008 to 2021. The population of the study consists of 9 listed banks in the Nigerian stock exchange. ICT was proxied by internet access, credit administration by loans and advance and non-performing loans by ratio of total loans. The ARDL and the Toda and Yamamoto causality models were adopted to assess the co-integrating nexus. Findings revealed that effective deployment and integration of ICT into banking operations significantly reduces fabricated customers' security documents and non-performing loans effect on banks profitability. The study recommends a comprehensive credit application scrutiny, and data sharing among banks, to minimise predatory debtors' impact on banks financial performance.

Keywords: Information and communication technology (ICT), credit administration, loans and advances, non-performing loans.

INTRODUCTION

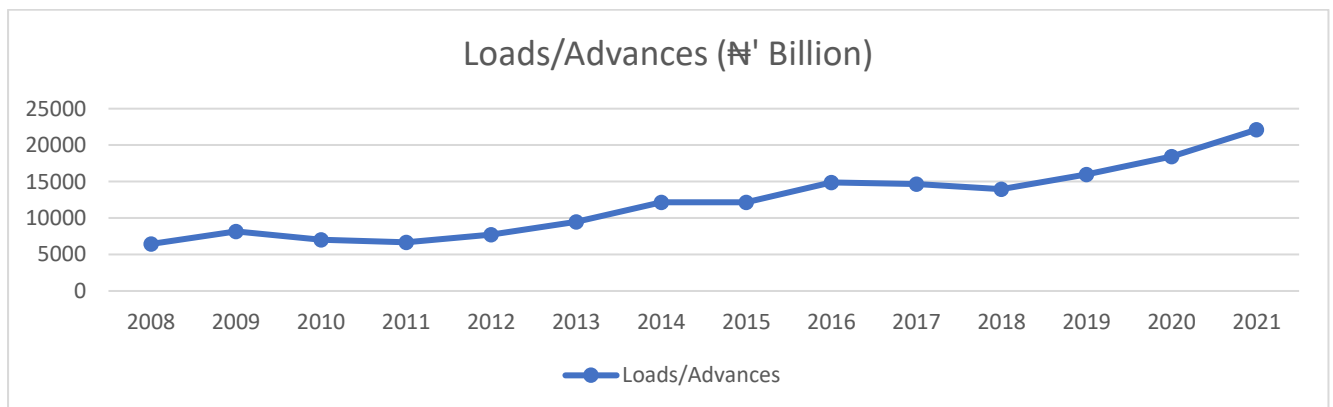
The relative stability in the global financial system and economy in the 21st century have profoundly influenced the advancements in information and communication technology (ICT), resulting in a more operational and resourceful credit administration processes to enhance productivity (Sassi & Goaid, 2013). In recent years, the integration of ICT into banking activities has restructured the conventional financial systems' operational and business activities to improve their efficiency and business intelligence (Sassi & Goaid 2013). The credit creation and administrative function of banks is a pivotal income-generating activity. This income-generating activity, poses significant operational risks to the lenders and borrowers, including the risk of counterparties defaulting on contractual obligations, which can disrupt the smooth functioning of the financial system, particularly banking operations through high Non-Performing Loans (NPLs). Bankruptcy risk emanating from high NPLs have been an untiring challenge for the banking sector and the economy and can be attributed to low credit standards, poor portfolio management, and adverse macroeconomic conditions (Hou &



Dickinson, 2007). Over the decades, the ripple effect of high NPLs on the banking sector and the economy has gained substantial attention. Empirically the findings of Hou and Dickinson (2007) revealed that banks' asset quality serves as a crucial predictor of bank insolvency and high NPLs. These findings underscore the significance of sustaining a robust asset quality, sound corporate governance, and effective credit risk management to mitigate the risk of bank insolvency.

In a bid to address the problems igniting NPLs increase and impeding effective credit administration, through regulatory and supervisory reforms fall short of expectations (Inekwe, 2010). The integration of ICT into banking activities has facilitated a resourceful interface with borrowers and the monitoring of investments through digital networks to address issues related to credit repayment and predatory debtors (Asongu, et al., 2016). The introduction of bank verification number (BVN) technology and electronic finance (E-Finance) has instrumentally contributed to adequate internal control over credit administration, financial reporting (Asongu & De Moor, 2017) and reducing bank insolvency. This is evidenced in the geometric increase in banks loans and advances (₦ Billion) (see figure 1).

Figure 1: Banks Loans and Advances (₦ Billion)



Source: Author (2022)

According to Donner (2006), ICT primarily drives economic and social development through employment and productivity stimulated by bank credit to private sector. As such, Donner revealed that a 10% increase in technology advancement reduces unemployment by 0.75% and increases per capita GDP by 1.02%. The findings of Pradhan et al (2018) substantiate the significance of technology in declining poverty rate, create employment opportunities, and enhance the human capital development through effective credit administration for investment purposes.

The findings of Waverman, Meloria, and Melvyn (2005) emphasise the facilitative role of the ICT sector in enhancing bank branch operations, increasing operational flexibility, and ensuring safer banking practices. Pradhan, et al (2018) revealed that ICT enables improved information collection on borrowers' activities, aiding in assessing creditworthiness and facilitating deposits.

This study broad objective to explore the link between ICT and credit administration in Nigeria and also capture the ripple effect of non-performing credit facilities and credit administration. Credit administration was proxied by loans and advances, and Internet (% of the population)

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as a crucial ICT policy variable for financial development. By covering a 21-year period from 2000 to 2021, this study contributes and add value to existing literature on electronic financial systems.

The significant contribution of this study lies in its assessment of the contributive impact of ICT on credit administration to reduce incidence of NPLs. Departing from the traditional regression models, the study employs the dynamic Autoregressive Distributed Lag (ARDL) model along with the Toda-Yamamoto procedure, which addresses potential biases allied with unit root and co-integration tests (Rambaldi & Doran, 1996). The study aims to underscore the significance of ICT in financial development, cost reduction, effect on NPLs and consequently enhance productivity.

1.2. Statement of the Problem

Over the decades the stability and operational functionality of the banking sector globally has been greatly impede by lux in credit administration policy framework. This is evidence in the geometric increase in non-performing credit facilities (NPLs) in banks contributing approximately 65.5% of the risk factors to bank failures. The ripple effect NPLs on liquidity, profitability, corporate image and overall efficiency of the banking sector is an upshot of poor communication and information exchange between banks and borrowers resulting to liability mismatch. The study aims to improve the efficacy of credit administration systems, which are pivotal in refining banks' operational and business activities for profitability and sustainability. Empirical findings from extant studies underlined various contributive factors to NPLs, including GDP level, inflation rate, unemployment, and deposit volume. Kanu and Hamilton (2014), Inekwe (2013), and Terzungwe and Simon (2013) recommended the examination of the effect of ICT on credit administration to address the challenges associated with NPLs and contribute to the sustainability and profitability of banks in the emerging banking systems of Nigeria currently underperforming due to NPLs effect. Therefore, the study seeks to leverage ICT to improve communication and information exchange between banks and borrowers, to mitigate the challenges associated with NPLs.

Objectives of the Study

The primary goal of this study is to investigate the effect of information and communication technology on credit administration in Nigeria. The specific objectives include:

1. Examine the effect of ICT on loans and advances in Nigeria.
2. Investigate the of ICT on non-performing credit facilities in Nigeria.
3. Evaluate the causal nexus between ICT, loans and advances, and non-performing credit facilities in Nigeria.

Literature Review

ICT Applications in Financial Practices of Credit Administration

ICT adoption and integration into the operational activities of the financial systems allow for effective communication between the bank and borrowers, and effective management of online services and valuable information (Asongu & De Moor, 2017). The financial intermediation function of the bank primarily serves as a funding sources for business through loans and advances (Daniel & Wandera, 2013). Unrecovered credit facilities are generally classified as



NPLs if interest and the principal amount are not repaid within a minimum of 90 days and is no longer expected in future dates. In this study, the NPLs were measured as the ratio of NPLs to total loans. NPLs, does not only affect banks profitability but also diminishes economic growth and increased unemployment. The effect of NPLs facilities directly reflects poor asset quality and bank credit administration is influenced by capital position, profitability, economic conditions, monetary and fiscal policies, interest rates, liquidity, and taxes (Reed & Gill, 1989, cited in Zewdu, 2010). In essence, this nexus underscores the significance of ICT in enhancing communication, managing financial operations, and addressing challenges related to NPLs in the banking sector's credit administration practices.

Evaluation of Credit

The significance of ICT in the evaluation of credit cannot be over-elaborate as it empowers credit officer's to thoroughly investigate, gather pertinent information, evaluate borrowers' prospective investments for both risk and profitability (Mather, 1962) and mitigate credit loss, particularly stemming from NPLs. In assessing credit safety, Mather (1962) outlined three fundamental principles to include: safety, suitability, and profitability. Safety, is characterised by borrower's character traits embracing honesty, integrity, and reliability, the loans and advance must align with legal guidelines, government policies, regulatory and supervisory regulations. For profitability ventures like pool betting, and speculative investments should be avoided to ensure compliance and mitigate NPLs risks, as banks operates with profitability objective. The interest earned on loans and advances constitutes a significant income source for banks (Mather, 1962).

Non-Performing Loans

Unrecovered credit facilities due for repayments in the last 90 days or more is considered NPLs. Similarly, Mikiko, (2003) argued that unpaid above 3 months is NPLs. NPLs are non-income-generating assets, representing credit risk within the banking system with a profound effect on economic growth. (Souza and Feijó, (2011) attribute the increase in NPLs to weaknesses in credit procedures, low-quality credit specialists, high markup spreads, and inadequate monitoring policies. NPLs according to Vouldis and Louzis, (2018) instigate banking crises and diminish overall performance and economic stability. In Pakistan, the State Bank of Pakistan (SBP) from 2005-2010 reported NPLs upsurge from 6.7% to 14.3%. The repercussions effect of NPLs is evidence in investment levels and dividend payments decline, and high interest rates (Stijepović, 2014).

Classification of Non-Performing Loans

In a bid to checkmate NPLs risk banks are required to assess their credit portfolio monthly, distinguishing between performing (active accounts) and non-performing (inactive accounts). Ogedengbe, (2014) revealed that NPLs are categorised based on the duration of delinquency and the provision for bad debt. As such:

1. Substandard: repayment is due and remain undercover for 90 days and less than 180 days. Provision for bad debt is made at 10%.
2. Doubtful accounts: repayments are outstanding for 180 days and less than 360 days—provision made at 50%.
3. Lost accounts: repayments are uncovered for a e year or 360 days and more. Provision is made at 100%.

Empirical Review

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The empirical review on NPLs reveals various insights into their determinants and effects across diverse economies. The findings of Kroszner (2002); Sultana (2002) links NPLs to financial crises. The risk of NPL arises due to economic depression. The findings of Salas and Saurina (2002); Carlos (2012) and Hu and Yung (2004) revealed a negative nexus between bank size and non-performing loans. They argued bigger banks diversified their portfolios to mitigate NPLs risks. Similarly, the findings of Carlos (2012); Saba et al. (2012) and others revealed a positive association between NPLs, inflation, and real GDP per capita on credit administration. Carlos (2012), using the regression model observed a negative nexus with GDP growth rate and a positive nexus with unemployment rate. In the U.S. banking sector, Saba, et, al (2012) observed a negative link between lending rate and a positive nexus with inflation and real GDP per capita on NPLs. In Nigeria, Inekwe (2010) argued that the substantial rise in NPLs over the years, poses significant challenges to the banking industry's health and development. Gadis (2014) identified various determinants of NPLs, to include; poor credit assessment, underdeveloped credit culture, feeble institutional capacity, prejudicial competition among banks, and others. In South Africa Waverman, Meloria, and Melvyn (2005) argued that ICT enhances bank branch operations, increase operational flexibility, and ensure safer banking practices. Pradhan, et al (2018) revealed that ICT improved information

Theoretical framework

The information asymmetry theory and agency theory underpinning this study shed light on the challenges arising from informational disparities and principal-agent relationships within organizations. The information asymmetry theory emphasises the importance of economic agents possessing superior information in negotiating favourable terms. NPLs in banks stem from adverse selection and moral hazard problems. The agency theory centres on the principal-agent problem and advocates for improved monitoring and incentives to align the interests of managers with those of shareholders.

Information Asymmetry Theory

The information asymmetric theory revealed that distinguishing between creditworthy and a bad borrower, is challenging, and led to adverse selection and moral hazard problems. The theory acknowledges that a market participant, with sufficient market information on a specific item can negotiate better terms than others with insufficient information (Auronen, 2003). NPLs in banks often result from adverse selection and moral hazard issues (Bester, 1994). Transaction-based lending and relationship lending are two categories of bank lending, with the former using initial information and the latter incorporating information obtained throughout the borrower relationship (Berger and Udell, 2002).

Agency Theory

The theory addresses the principal-agent problem by advocating for improved monitoring and incentives for managers. Agency issues influence managers' risk-taking behaviour and corporate risk management strategies (Smith & Stulz, 1985). Asymmetric earning distributions between shareholders and debt holders lead to firms undertaking high-risk projects or neglecting positive net value projects (Smith & Stulz, 1987). Agency theory suggests that defined hedging policies can influence firm value (Fite & Pflleiderer, 1995). In summary, both theories highlight the importance of managing information asymmetry and agency issues in financial transactions and corporate governance to mitigate adverse outcomes and enhance firm value.



Methodology

The population of the study consists of 9 listed banks in the Nigerian stock exchange (see Table 1). The study adopted the expo-facto research design to assess the long and short run nexus.

Table 1: Population of the study

Company	Date Listed	Date Incorporated
Ecobank Transnational Incorporated	September 11, 2006	October 3, 1985
Fidelity Bank Plc	May 17, 2005	November 19, 1987
Jaiz Bank Plc	-	April 1, 2003
Sterling Bank.	August 17, 1993	November 25, 1960
Union Bank Nig.Plc.	-	May 30, 1969
United Bank for Africa Plc	March 31, 1970	February 23, 1961
Unity Bank Plc	-	April 27, 1987
Wema Bank Plc.	-	May 2, 1945
Zenith Bank Plc	October 21, 2004	May 30, 1990

Source: Author (2022)

Sample and Sampling Technique

The Banks, in reference were selected for its extensive operation duration, wide coverage and listing on the Nigerian Stock Exchange (NSE). By spanning 13 years from 2008-2021, this study examines credit administration through loans and advances alongside NPLs. Data extracted from the bank's annual financial statements was employed to assess ICT and credit management nexus and reduction in NPLs in the Nigerian banking system with profitability as a key consideration. NPLs is measured as the ratio of NPLs to total loans and ICT is measured by internet penetration (% of the population).

Model Specification

The estimated modified model is specified as follows in a linear form:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \mu_t \dots \dots \dots \text{(eq 1)}$$

Hypothesis 1: $LAN_t = f(ICT_t, EXCH_t, PRIM_t, RGDP_t,) \dots \dots \dots \text{(eq 2)}$

Hypothesis 2: $NPL_t = f(ICT_t, EXCH_t, PRIM_t, RGDP_t,) \dots \dots \dots \text{(eq 3)}$

Where: Y = Dependent variable; β_0 = Constant; the value Y assumes when the independent variable is zero; $\beta_1- \beta_3$ = Coefficient; the rate of change in Y

t = Time; **X₁-X₃** = The independent variables; **μ_t** = Error Term

Unit Root

The unit root test used the Augmented Dickey-Fuller (ADF) and Zivot and Andrews (1992). To assess the stationarity and structural break test proposed by Zivot and Andrews (1992) following three equations:

$$\Delta y_t = c + \Delta y_{t-1} + \beta_t + \gamma DT_t + \sum_{j=1}^k d_j \Delta y_{t-1} + \epsilon_t \dots \dots \dots \text{ZAU Model (4)}$$

$$\Delta y_t = c + \Delta y_{t-1} + \beta_t + \theta DT_t + \sum_{j=1}^k d_j \Delta y_{t-1} + \epsilon_t \dots \dots \dots \text{ZAU Model (5)}$$

$$\Delta y_t = c + \Delta y_{t-1} + \beta_t + \theta DU_t + \gamma DT_t + \sum_{j=1}^k d_j \Delta y_{t-1} + \epsilon_t \dots \dots \dots \text{ZAU Model (6)}$$

Where: DU_t = dummy variable for a mean shift occurring at each possible break-date (T.B.) while DT_t = corresponding trend shift variable.

The ADF test is considered superior for its popularity and wide application.



The Autoregressive Distributed Lag (ARDL)

The ARDL was employed to examine the co-integrating nexus ICT and credit administration in Nigeria. The model was adopted as a result of its numerous benefits over others. The model for these variables X, Y, and Z can be expressed as:

$$Dyt = \emptyset_1 + \Upsilon_1 y_{t-1} + \Upsilon_2 z_{t-1} + \Upsilon_3 x_{t-1} + \emptyset_1 \sum_{i=1}^n \Delta y_{t-1} + \theta_2 \sum_{i=1}^n \Delta x_{t-1} + \theta_3 \sum_{i=1}^n \Delta z_{t-1} + \epsilon_{1t} \quad (\text{Eq7})$$

Where: $\Upsilon_1, \Upsilon_2, \Upsilon_3$ = long run coefficients whose sum is equivalent to the error correct term at ECM model and $\theta_1, \theta_2, \theta_3$ are short-run coefficients.

Equations (2 & 3) are expressed in ARDL long form to test the study hypotheses:

$$\Delta LAN_{qt} = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta LAN_{qt-i} + \sum_{i=0}^p b_i \Delta L_n LR GDP_{qt-2} + \sum_{i=0}^p b_i \Delta L_n LICT_{qt-3} + \sum_{i=0}^p c_i \Delta L_n PRIM_{qt-4} + \sum_{i=0}^p d_i \Delta L_n EXCH_{qt-5} + \delta_1 LAN_{qt-1} + \delta_2 L_n RGDP_{qt-2} + \delta_3 ICT_{qt-3} + \delta_4 PRIM_{qt-4} + \delta_5 I_n EXCH_{qt-5} + \mu_{qt} \dots \dots \dots (\text{eq8}).$$

$$\Delta NPL_{qt} = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta NPL_{qt-i} + \sum_{i=0}^p b_i \Delta L_n LR GDP_{qt-2} + \sum_{i=0}^p b_i \Delta L_n LICT_{qt-3} + \sum_{i=0}^p c_i \Delta L_n PRIM_{qt-4} + \sum_{i=0}^p d_i \Delta L_n EXCH_{qt-5} + \delta_1 LAN_{qt-1} + \delta_2 L_n RGDP_{qt-2} + \delta_3 ICT_{qt-3} + \delta_4 PRIM_{qt-4} + \delta_5 I_n EXCH_{qt-5} + \mu_{qt} \dots \dots \dots (\text{eq9})$$

Further, Eq. (8 & 9) is expressed in matrix form, where each study variable serves as the dependent variable in the model (10).

To estimate the cointegration, hypotheses 1 & 2 were formatted for both cases:

- a. (H₀) no cointegration [$H_0: \gamma_{11} - \gamma_{55} = 0$].
- b. (H₁) there is cointegration [$H_0: \gamma_{11} - \gamma_{55} \neq 0$].
- c. For short-run, (H₀) no short-run nexus [$H_0: \mu_{11} - \mu_{55} = 0$],
- d. (H₁), there is a short-run nexus [$H_0: \mu_{11} - \mu_{55} \neq 0$]

$$(1-B) \begin{bmatrix} \Delta RGDP \\ \Delta ICT \\ \Delta NPL \\ \Delta LAN \\ \Delta EXCH \\ \Delta PRIM \end{bmatrix} = \begin{bmatrix} a_{01} \\ a_{02} \\ a_{03} \\ a_{04} \\ a_{05} \end{bmatrix} + \sum_{i=1}^k 1 - B \begin{bmatrix} \Delta RGDP \\ \Delta ICT \\ \Delta NPL \\ \Delta LAN \\ \Delta EXCH \\ \Delta PRIM \end{bmatrix}_{t-i} \times \begin{bmatrix} \mu_{11} & \mu_{12} & \mu_{13} & \mu_{14} & \mu_{15} \\ \mu_{21} & \mu_{22} & \mu_{23} & \mu_{24} & \mu_{25} \\ \mu_{31} & \mu_{32} & \mu_{33} & \mu_{34} & \mu_{35} \\ \mu_{41} & \mu_{42} & \mu_{43} & \mu_{44} & \mu_{45} \\ \mu_{51} & \mu_{52} & \mu_{53} & \mu_{54} & \mu_{55} \end{bmatrix} + \begin{bmatrix} \Delta RGDP \\ \Delta ICT \\ \Delta NPL \\ \Delta LAN \\ \Delta EXCH \\ \Delta PRIM \end{bmatrix}_{t-i}$$

$$+ \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} & \gamma_{15} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} & \gamma_{25} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} & \gamma_{35} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} & \gamma_{45} \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & \gamma_{55} \end{bmatrix} \times \begin{bmatrix} \omega \\ \omega \\ \omega \\ \omega \\ \omega \end{bmatrix} \dots \dots \dots (\text{Eq10})$$

Where Δ = the first difference operator,
 The coefficients $\mu_1 - \mu_5$ and $\gamma_0 - \gamma_5$ = short-run and long-run elasticities, respectively.
 α_0 = constant term and ω_t = white noise.
 The acceptance or rejection of the hypothesis is based on a comparison between the f-statistic and the critical value.

Table 1 Decision Rules for the Bound Tests Process

State	Remark
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F-statistic > upper critical bound value	cointegrating exists
F-statistic < lower critical bound (LCB) value	No cointegrating relationship exists
F-statistic falls within bounds	Results are inconclusive

Hypothesis Three

There is no casual nexus between information and communication technology, loans and advances and non-performing credit facilities in Nigeria.

The Toda and Yamamoto (1995) was adopted to test the direction of causality nexus among the variables and its allows for long-run information omitted in systems that require first differencing and pre-whitening (Clarke & Mirza, 2006). The VAR system is expressed as:

$$LAN_t = \alpha_0 + \sum_{j=1}^{k+dmax} \alpha_{1j}LAN_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j}PRIM_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{3j}RGDP_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{4j}EXCH_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{5j}NPL_{t-j} + \varepsilon_{1t} \dots \dots \dots (eq12)$$

Where: k = lag length, (k + dmax) is the order of VAR: α_j 's, λ_j 's, ϕ_j 's, δ_j 's, ψ_j 's, and π_j 's, are parameters to be estimated; and ε_{1t} , ε_{2t} , ε_{3t} , ε_{4t} , and ε_{5t} are error terms that are assumed to be white noise. The ICT_t , NPL_t , and LAN_t , equations (12) are relevant. Causality runs from ICT_t , NPL_t , and LAN_t , if, $a_{2j} \neq 0$ in equation (12).

Where: NPL = Non-performing loans; LAN= Loans and advance; ICT = Internet (% of the population); EXCH = Exchange Rate; PRIM = Prime Lending Rate; RGDP = Real Gross Domestic Product.

Analysis

Descriptive Statistics

Table 2 Descriptive Statistics

	RGDP	LAN	NPL	EXCH	PRIM	ICT
Mean	10.75	10.78	9.23	9.20	8.76	18.92
Median	10.86	18.21	13.80	14.18	14.38	20.97
Std. Dev.	0.38	9.91	8.64	8.55	8.12	4.80
Skewness	-0.55	-0.17	-0.07	-0.10	-0.12	-0.30
Kurtosis	1.94	1.042	1.13	1.10	1.09	1.41
Jarque-Bera	8.65	14.48	12.80	13.29	13.56	10.57
Prob...	0.013	0.071	0.016	0.013	0.011	0.050

Source: Author (2022)

Table 2 show the rudimentary descriptive statistics results emphasising “mean and median” and standard deviation. The positive mean return indicates ICT's impact on bank credit administration. The skewness statistic shows the series is negatively skewed. The kurtosis statistic shows that the variables are platykurtic.

Pre-Estimation Tests

ADF (Trend and Intercept)	Zivot -Andrews (Trend and Intercept)
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Variables	ADF Stat	Critical Value (0.05)	Order of Integration	ZAU Stat	Critical Value (0.05)	Break Date	Inference
LogICT	-6.438	-3.520	I (1)	-8.13	-5.09	2010Q4	Stationary
LogRGDP	-8.085	-3.467	I (1)	-5.89	-4.42	2010Q1	Stationary
LogNPL	-5.101	-3.529	I (0)	-8.30	-5.08	2012Q3	Stationary
LogLAN	-6.848	-3.520	I (1)	-8.78	-5.08	2013Q3	Stationary
EXCH	-5.827	-3.540	I (1)	-8.76	-5.08	2015Q4	Stationary
PRIM	-9.023	-3.465	I (0)	-5.44	-4.08	2010Q1	Stationary

Source: Authors Computation (2021)

The results exhibit diverse stationarity properties at levels I (0) and first difference I (1). This satisfies the condition for the adoption of the ARDL as advocated for by Pesaran, Shin, and Smith (2001).

Test of Hypotheses

Hypothesis one.

H_0 ICT has a long-run effect on Nigeria's loans and advances.

Table 2 ARDL Long Run Estimate

Panel A Long Run Model Structure (2,1,1,1,1)					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Expectations
LOGRGDP	0.696035	0.072676	9.577233	0.0000	(+)
PRIM	-0.593040	0.574120	-1.033677	0.3075	(+)
EXCH	0.108850	0.662108	0.164399	0.9099	(+)
ICT	0.416010	0.106001	-3.924585	0.0003	(+)
C	10.59584	0.077036	137.5441	0.0000	
EC = LOGLAN (0.6960*LOGRGDP -0.5930*PRIM +0.1088*EXCH + 0.4160*ICT + 10.595)					
Panel B Other Parameter Estimate					
R ²	0.99	F-Stat	492.581	Prob (Stat)	0.0000
Adjusted R ²	0.99	DW stat	2.00		

Source: Author (2022)

In the long run, other parameter estimates result in (**Panel B**) shows R² of 99%, revealing that the regressors and moderating variables explain the variation in LAN within the context of this model. The Adjusted R² value of 99% indicates fitness of the model line. The F-test of 492.581(0.0000) confirms the overall stability and significance of the model at 5%, 1% even 10% for a meaningful analysis. Additionally, the D-W statistics of (2), by the rule of thumb, rule out any suspicion of AR (1) autocorrelation.

Table 3 ARDL Bound Test Results

F-Bounds Test		Null Hypothesis: No levels of relationship			
Test Statistic	Value	Signif.	I(0)	I(1)	

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			Asymptotic: n=1000	
F-statistic	23.1625	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author (2022)

The F-statistics (23.162) exceeds the upper bound value (3.49) at 5% significance, indicating cointegration. Short-run departures may influence long-run convergence. On the evidence of cointegration, the short-run ECM was conducted.

Table 4 ARDL ECM Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.740940	0.058973	-12.56405	0.0000

Source: Author (2022)

The ECM results show that the value of the ECM (CointEq(-1)) is negative and significant, confirming the cointegrating nexus. The (CointEq(-1)) value of (-0.740) indicates the speed of convergence of loans and advances from the short-run deviation arising from default, among others, to long-run equilibrium at 74% annually.

Hypothesis Two

H₀: ICT on non-performing credit facilities in Nigeria.

Table 5 ARDL Long Run Estimate

Panel A		Long Run Model Structure (2,1,1,1,1)			
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Expectations
LOGRGDP	-0.116504	0.057380	-2.876263	0.0491	(+)
ICT	0.246301	0.120709	-2.040452	0.0483	(+)
EXCH	0.370702	0.130700	2.836419	0.0089	(+)
PRIM	0.145086	0.042081	3.447779	0.0015	(+)
C	10.09450	0.264866	38.11175	0.0000	
EC = LOGNPL - (0.1165*LOGRGDP +0.2463*ICT + 0.3707*EXCH + 0.1450*PRIM +10.0945)					
Panel B Other Parameter Estimate					
R ²	0.77	F-Stat	528.210	Prob (Stat)	0.0000
Adjusted R ²	0.72	DW stat	2.00		

Source: Author (2022)

In the long run, other parameter estimates result in (**Panel B**) shows R² of 77%, revealing that the regressors and moderating variables explain the variation in NPL within the context of this model. The Adjusted R² value of 72% indicates fitness of the model line. The F-test of 528.210 (0.0000) confirms the overall stability and significance of the model at 5%, 1% even 10% for a meaningful analysis. Additionally, the D-W statistics of (2), by the rule of thumb, rule out any suspicion of AR (1) autocorrelation.

Table 6 ARDL Bound Test Results

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F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	22.11163	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author (2022)

The F-statistics value of (22.111) is more significant than 3.49 (upper bound value) at 5% significance. Indicating short run departure influenced the individual series speed of convergence to long run equilibrium. On the evidence of cointegration, the short-run ECM was estimated.

Table 7 ARDL Error Correction Estimation (ECM) Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGICT(-1))	-0.183879	0.098224	-1.872049	0.0687
CointEq(-1)*	-0.396741	0.049715	-7.980334	0.0000

Source: Author (2022)

The ECM results show that the (CointEq(-1)) is negative and significant, confirming at (-0.396) indicating the speed of convergence of loans and advances from the short-run deviation arising from default, among others, to long-run equilibrium at 39% annually.

Hypothesis Three

H₀: Nigeria has no significant causal nexus between information and communication technology, loans and advances, and non-performing credit facilities.

The VAR causality approach computes statistics asymptotically following the chi-square (χ^2) distribution. The results are reported in Table 8.

Table 8 Causality Between Fintech and Economic Growth in Nigeria

Panel A		Dependent variable: LOGLAN		
Excluded	Chi-sq	Df	Prob.	
LOGRGDP	17.782060	4	0.0029	
LOGICT	14.777825	4	0.0109	
EXCH	14.21644	4	0.0066	
PRIM	9.122630	4	0.0581	
All	165.4515	16	0.0000	
Panel B		Dependent variable: LOGNPL		
Excluded	Chi-sq	Df	Prob.	
LOGRGDP	7.151403	4	0.1281	
LOGICT	5.051141	4	0.2821	
EXCH	2.631143	4	0.6213	
PRIM	2.837469	4	0.5854	
ALR	10.06904	4	0.0393	
All	59.42319	16	0.0083	

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Source: Author (2022)

Discussion of Results

Panel (As) of Tables 2 and 5 show the results of formulated tested hypotheses (one and two) within the sample period. **Hypothesis 1** shows a long-run positive and significant link between RGDP, EXCH, and ICT. This is consistent with a priori expectations. However, a negative and non-significant nexus was found between PRIM and LAN. From the results, it can be inferred loans and advances to economic agents increases economic activities by 69% in the long run. A 1% change in exchange rate instigates loan repayment default in the long run due to poor financial performance. The prime lending rate shows a negative nexus, implying that economic agents borrow regardless of the rate so far, and the economic climate is favourable for investment and repayment in the long run.

Hypothesis 2 the link between ICT, EXCH, and PRIM is positive and significant. This is consistent with a priori expectations. However, a negative and non-significant nexus was found between RGDP and NPL. From the results, it can be inferred that a unit increase in the percentage of non-performing loans decreases economic growth by 11.6%. Increasing ICT application in credit administration decreases the rate of non-performing loans by 24.6%. Exchange and prime lending rates impact non-performing loans by 37% and 14.5%, respectively.

ICT positively and significantly impacts loans and advances and non-performing loans. ICT adoption and integration into the operational activities of the financial systems allows for effective communication between the bank and borrowers, and management of online services and valuable information (Asongu & De Moor, 2017). ICT has also significantly resolved issues related to borrowers' attitudes towards credit repayment using the bank verification number (BVN) technology. ICT adoption checkmates the negative effect of information asymmetry.

Hypothesis Three:

At a 5% level of significance, the causality test shows ICT, RGDP, EXCH, and PRIM jointly and individually affect banks' loans and advances in the short run, with ICT, EXCH, and PRIM driving bank loans and advances. The LAN value of 165.4515, rejects the null hypothesis, indicating ICT Granger-causes bank loans and advances. However, there's no feedback; banks' loans don't cause ICT. In **Panel B**, no short-run causal effect was observed for non-performing loans. Further, the assessment reveals that the LAN value of 59.42319. The study supports Patrick's (1966) stage of growth hypothesis, suggesting government support and economic stability shape investment.

Decision Criteria: Reject the null hypothesis if the prob-value of the chi-square (X^2) is ≤ 0.05
Conclusion

The study revealed a positive ICT and credit administrations link with loans, advances, and non-performing loans exhibiting a positive and casual link with ICT. Extant literature supports that an increase in bank loans and advances stimulates economic growth, while non-performing loans diminishes development. The ICT sector is vital, in fostering sustainable development and its integration into the operational activities of banks' particularly credit administration reduces non-performing loans.

Recommendations

The recommendations are induced from the findings as follows:

Effect of Information Communication Technology on Credit Administration on Deposit Money Banks in Nigeria



1. Credit administrators should pay comprehensive attention to prospective borrowers' credit applications as a diligent and strict appraisal of such applications is vital in mitigating the incidence of repayment defaults on maturity.
2. Banks should share data among themselves, especially regarding credit applications, to mitigate the problem of predatory debtors in the banking system who abandon their debt obligations in one bank and contract new debts in other banks.

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ARDL Long Run Form and Bounds Test
 Dependent Variable: D(LOGLAN)
 Selected Model: ARDL(2, 1, 1, 1, 1)
 Case 2: Restricted Constant and No Trend
 Date: 12/27/22 Time: 09:41
 Sample: 2008 2021
 Included observations: 12

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.410057	2.231149	0.631987	0.6412
LOGLAN(-1)*	-0.029260	0.138832	-0.210758	0.8678
LOGRGDP(-1)	0.017336	0.274635	0.063122	0.9599
PRIM(-1)	-0.055078	0.009568	-5.756697	0.1095
EXCH(-1)	-0.001500	0.000384	-3.904246	0.1596



ICT(-1)	0.015169	0.001571	9.652854	0.0657
D(LOGLAN(-1))	0.551374	0.056731	9.719121	0.0653
D(LOGRGDP)	-5.077808	0.927974	-5.471931	0.1151
D(PRIM)	-0.008454	0.004712	-1.793895	0.3237
D(EXCH)	-0.010316	0.001386	-7.440787	0.0850
D(ICT)	-0.009091	0.001232	-7.380075	0.0857

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGRGDP	0.696035	0.072676	9.577233	0.0000
PRIM	-0.593040	0.574120	-1.033677	0.3075
EXCH	0.108850	0.662108	0.164399	0.9099
ICT	0.416010	0.106001	-3.924585	0.0003
C	10.59584	0.077036	137.5441	0.0000

$$EC = LOGLAN (0.6960*LOGRGDP -0.5930*PRIM +0.1088*EXCH + 0.4160 *ICT + 10.595)$$

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	23.1625	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Finite Sample: n=35				
Actual Sample Size	12	10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
Finite Sample: n=30				
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84

ARDL Error Correction Regression
Dependent Variable: D(LOGLAN)
Selected Model: ARDL(2, 1, 1, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 12/27/22 Time: 09:44
Sample: 2008 2021



Included observations: 12

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.740940	0.058973	-12.56405	0.0000
R-squared	0.999267	Mean dependent var		0.083180
Adjusted R-squared	0.998657	S.D. dependent var		0.128237
S.E. of regression	0.004700	Akaike info criterion		-7.575546
Sum squared resid	0.000133	Schwarz criterion		-7.333092
Log likelihood	51.45327	Hannan-Quinn criter.		-7.665310
Durbin-Watson stat	2.328442			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	23.1625	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

ARDL Long Run Form and Bounds Test
 Dependent Variable: D(LOGNPL)
 Selected Model: ARDL(2, 0, 0, 1, 0)
 Case 2: Restricted Constant and No Trend
 Date: 12/27/22 Time: 11:41
 Sample: 2008 2021
 Included observations: 12

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-101.5913	61.15621	-1.661177	0.1720
LOGNPL(-1)*	-1.640836	0.518703	-3.163343	0.0341
LOGRGDP**	11.71878	5.976808	1.960709	0.1215
ICT**	-0.022166	0.051010	-0.434544	0.6863
EXCH(-1)	0.013221	0.006055	2.183497	0.0944
PRIM**	-0.097906	0.203597	-0.480882	0.6557
D(LOGNPL(-1))	0.365998	0.330828	1.106308	0.3306
D(EXCH)	-0.006486	0.012083	-0.536809	0.6199



* p-value incompatible with t-Bounds distribution.
 ** Variable interpreted as $Z = Z(-1) + D(Z)$.

Levels Equation
 Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGRGDP	-0.116504	0.057380	-2.876263	0.0491
ICT	0.246301	0.120709	-2.040452	0.0483
EXCH	0.370702	0.130700	2.836419	0.0089
PRIM	0.145086	0.042081	3.447779	0.0015
C	10.09450	0.264866	38.11175	0.0000

$$EC = \text{LOGNPL} - (0.1165 \cdot \text{LOGRGDP} + 0.2463 \cdot \text{ICT} + 0.3707 \cdot \text{EXCH} + 0.1450 \cdot \text{PRIM} + 10.0945)$$

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	22.111633 4	Asymptotic: n=1000		
		10%	2.2	3.09
		5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	12	Finite Sample: n=35		
		10%	2.46	3.46
		5%	2.947	4.088
		1%	4.093	5.532
		Finite Sample: n=30		
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84



Transform Data

	EXCH	LOGLAN	LOGNPL	LOGRGDP	PRIM	ICT
2008	117.7823	8.770763	17.36150	10.75370	15.13543	8.000000
2009	147.2718	9.005882	16.66847	10.83100	18.99083	9.300000
2010	148.3100	8.856272	15.70561	10.92359	17.58562	11.50000
2011	151.8269	8.807749	15.63925	10.97130	16.02131	13.80000
2012	155.4502	8.952051	18.29858	11.01321	16.79031	16.10000
2013	155.2537	9.157817	17.15121	11.06574	16.72283	19.10000
2014	156.4848	9.404528	17.48735	11.12693	16.54839	21.00000
2015	191.8035	9.404949	17.33887	11.15311	16.84845	36.00000
2016	253.0925	9.607256	17.45496	11.13681	16.86808	25.67000
2017	305.2899	9.593024	18.74023	11.14484	17.55502	19.46944
2018	305.5827	9.544330	19.04909	11.16388	19.32667	32.46944
2019	306.4227	9.680084	19.07800	11.18573	15.52790	37.46944
2020	358.3108	9.822747	19.12316	11.16762	12.31933	47.46944
2021	401.9847	10.00404	19.14009	11.20344	11.55463	57.46944