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RESEARCH PAPER

Emerging Technology Adoption and Financial Performance of Deposit Money Banks in Nigeria

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Abstract

Technology has become an increasingly critical success factor in modern-day banking like many other aspects of human life: driving competition, process, operation, and customer service delivery and satisfaction. This study examined the effect of emerging technology adoptions on the financial performance of Deposit Money Banks (DMBs) using monthly data collected on Deposit Money Banks (DMBs) in Nigeria between 2012 and 2019. The Fully Modified Ordinary Least Squares (FMOLS) regression method was employed for data analysis. The result shows that emerging technology variables such as Web Payment, Mobile Money operators, Automated Teller Machines, and Point of Sale terminals have positive long-run relationships with bank performance in Nigeria. Hence, the study concluded that emerging technology adoption boosts the financial performance of DMBs in Nigeria. Thus, it is apparent that DMBs need to ensure viable investment in emerging technologies to promote their performance and strengthen their capacity for good quality service delivery in a highly competitive banking environment on the digital revolution trajectory.

Keywords: Banks, Depository Institutions, Emerging Technology, Mobile Banking, Online Banking.
JEL Classification: G21.

1. Introduction

In the present dynamic business environment, the emergence and adoption of various technologies aimed at snowballing service delivery, market size, and customer satisfaction is a common phenomenon. This trend has been recognized as one of the main driving forces behind firm competitiveness as emerging technologies have

altered every sphere of human activities with the banking sector showing larger adoption of such technologies in various aspects of their operations (PWC, 2016).

Such adoption has drastically transformed the nature of banking business across the world in terms of a significant increase in volume, speed, and extent of banking businesses that can be undertaken arising from increasing quantum of business opportunities for banks. While there are several consequences of such paradigm shift in operations and mode of service delivery, its desirable influence in terms of improved revenue, market size, and collaboration often convinces bank management quickly as they tend to trace their improved firm performance to the adoption of new technologies because it not only significantly expanded their scope of service delivery but has also brought a quantum leap in quality-of-service delivery.

Agu and Aguegboh (2020) opined that banks that change their payment and service delivery channels using emerging technologies tend to survive competition and outshine others. He suggested a consistent appraisal of service delivery channels to position them efficiently in line with the dynamics of emerging technologies. Arnabodi and Claeys (2010) advised that purveyors of financial services must adopt and effectively operationalize new techniques for optimal service delivery to survive new business challenges in the 21st century and beyond. Certainly, the rapid changes in the adoption of emerging technologies have minimized the geographical barriers and created an electronic world (e-world). Explicitly, technological modernizations have created a global revolution in banking processes and procedures to ensure extensive delivery of a wide range of value-added services. Thus, Deposit Money Banks (DMBs) have come to terms with the role and relevance of emerging technologies which facilitate the integration of banks in a centralized network to create accessible service delivery points to clients, by investing heavily in sophisticated technologies within the last decade (Aggreh et al., 2020).

Such investments comprise a wide range of value-added products and services through Mobile Banking (MB), Point of Sale Terminal (POST), Web Payment (WP), and Automated Teller Machines (ATM). It has resulted in increasing technological acceptance among customers due to improved comfort, convenience, and ease of completing bank transactions anywhere and anytime using different platforms (Nguyen, 2021). Similarly, such adoption tends to reduce the relevance of agents and unnecessary distortions in bank service delivery using online, structured, and unstructured platforms.

While it is well noted that the adoption and continuous utilization of such technologies tend to impose huge costs on banks, the exact nature of the effect of the adoption on bank performance is blurred in the literature. Most authors are silent over

whether the effect is instantaneous or gradual on performance since there is a time lag between the adoption, acceptance, and generalization of emerging technologies among bank customers (Aggreh et al., 2020; Agu and Aguegboh, 2020; Nguyen, 2021; Adiga et al., 2022). Thus, this paper examines the influence of emerging technology adoption on the performance of DMBs in Nigeria. The remaining aspect of this paper comprised a brief literature review, method, results and discussion as well as conclusion and recommendations.

2. Literature Review

The Resource-Based Theory (RBT) provides the theoretical foundation for this study. The theory emerged from strategic management and postulates that firms engage in business competition based on the extent of their resources and capabilities (Peteraf and Bergen, 2003). Several theoretical perceptions have been drawn from this theory, one of which is to use it in explaining a wide range of emerging technology adoption in various business activities to gain significant competitive advantage and post improved performance (Bharadwaj, 2000).

De Young (2007) explored the influence of e-banking on banks performance of banks in the United States by comparing orthodox and modern service delivery processes. The inferential statistical results show that e-banking is driven by cost minimization and revenue maximization objectives, which have a positive and significant influence on banks' profitability. Likewise, Arnabodi and Claeys (2010) investigated the influence of innovation on European banks' performance using two online strategies in sixty banks between 1995 and 2005. The result of the analyses revealed that though, the innovation results in labor cost reduction, it is blurred on the extent of translating such to improved productivity due to huge IT costs. Also, Mohammad (2011) examined the effect of ICT investment on banks profitability in Pakistani banks and the results showed that ICT channels have increased competition among banks, reduced queues, and increased profitability, Sadr and Seyed (2013) studied the connection between ICT investment and productivity in specific Asian countries and the results revealed a short run stable relationship among the specified measures. In the cross-section, ICT has a positive effect on productivity.

Also et al. (2020) explored the influence of ICT investment in Thirty-Five (35) African banks between 2013 and 2015 using the Generalized Method of Moment statistical technique. The result revealed that ICT investment influences bank performance in the short and long term, and is significantly beneficial to the performance of the banks. In summary, bank performance is better enhanced by the adoption of technology especially through the deployment of various electronic and

web-based payment channels leading to more efficient banking services, improved transaction volume, higher customer satisfaction, and profitability.

In the same vein, Oyewole et al. (2013) evaluated the influence of ICT investment on bank performance in Nigeria using measures such as ROA, ROE, and NIM between 2000-2010, the result of panel data analysis revealed that ICT investment exert sa positive influence on bank performance in lag 2 but a negative influence in lag 1. Equally, Hassan et al. (2013) measured the influence of electronic banking services on performance listed Deposit Money Banks in Nigeria and the results revealed that the deployment of e-banking services has a positive and significant influence on bank performance, while e-direct and SMS have no significant influence.

Adiga et al. (2022) explored the influence of financial technology on Deposit Money Banks (DMBs) performance in Nigeria from 2005 to 2020 using measures such as payment system, automated clearing services and remittance services against interest income, non-interest income, return on assets and return on equity. The result of the Auto Regressive Distributed Lag (ARDL) model showed that financial technology measures have not been able to explain variations in bank performance. The analysis produced a mixed outcome of the relationship between components of FINTECH and bank performance, while the relationship between FINTECH components and ROE, non-interest income is significant whereas, FINTECH components and ROA, interest income have an insignificant relationship. More, importantly, the various components of FINTECH could not consistently produce the expected positive relationship with the various measures of bank performance and sometimes produce either positive or negative outcomes at different lag lengths. The study, therefore, could not reach a holistic conclusion between FINTECH components and indicators of banking sector performance (ROA, ROE, II, NII) in Nigeria.

3. Methodology and Data

This study adopts an ex-post facto research design since it is characterized by quantitative analysis of historical financial data. The population of the study comprised all the 22 licensed Deposit Money Banks (DMBs) in Nigeria and covered all their reported economic activities. Monthly secondary data on measures of emerging technologies adoption based on the amount dispensed to customers using Web Payment (WEB), Mobile Operation (MO), Automated Teller Machine (ATM), Point of Sale (POS), and Total Assets were obtained from the Central Bank of Nigeria (CBN) and Nigeria Inter-Bank Settlement System (NIBSS) websites covering the period of 2012-2019 and bank performance measure using Return on Assets (ROA)

For analysis, the cointegration regression model was used to estimate the influence of specified emerging technologies adoption measures on Deposit Money Banks (DMBs) Performance in Nigeria based on the tenet of the resource-based theory and the baseline equation operationalized as:

$$Y_{it} = \lambda_0 + \lambda_1 X_1 + \lambda_2 X_2 + \lambda_3 X_3 + \lambda_4 X_4 + \lambda_5 X_5 + \epsilon_i \quad (1)$$

where Y = Monthly Return on Asset of DMBs (in Percentage)

λ_0= Intercept

X_1 = Total Transaction through Web Payment Platforms

X_2 = Total Transaction through Mobile Money Operators

X_3 = Total Transaction through Automated Teller Machines

X_4 = Total Transaction through Point-of-Sale Terminals

X_5 = Total Assets of the DMBs

Ɛ = Error term

$\lambda_1 - \lambda_5$ = Regression Coefficients

while the log form of the model (which is used to adjust for time variant and noise) is given as:

$$Y_{it} = \lambda_0 + \lambda_1 logX_1 + \lambda_2 logX_2 + \lambda_3 logX_3 + \lambda_4 logX_4 + \lambda_5 logX_5 + \epsilon_i \quad (2)$$

The study adopts the Fully Modified Ordinary Least Square (FMOLS) approach in estimating the influence of emerging technologies adoption on DMBs performance in Nigeria. The FMOLS is ideal for getting regression results that consider the possible lags in activities and performance as well as being asymptotically efficient, and consistent without non-exogeneity and serial correlation. The FMOLS is preceded by a simple descriptive statistic, unit root test, and co-integration analysis which support and justify the use of the adopted technique. Descriptive statistics gives stylized facts on the features of the variables in the model while inferential statistics facilitates the establishment of the extent of influence of emerging technologies adoption on the financial performance of DMBs in Nigeria.

4. Results and Discussion

Table 1 presents the descriptive statistics on the emerging technologies adoption and financial performance of DMBs in Nigeria.

Table 1. Descriptive Statistics

	Web Payment in Billion (₦)	Mobile Operators in Billion (₦)	ATM Operations in Billion (₦)	Point of Sale Terminal in Billion (₦)	Return on Asset (%)	Total Asset in Billion (₦)
Mean	31,925.62	97,729.40	603,580.6	148,953.2	2.1001	1571.84
Median	13,833.80	46,923.26	583,716.3	624,65.44	2.0387	913.9475
Maximum	103,497	377,265.20	875,519.3	438,614.2	2.7000	5834.098
Minimum	2,276.46	2,297.69	295,416.7	2,587.600	1.6400	18.048
Std. Dev.	34,083.35	114,662.50	217,459.0	156,075.0	0.2495	1539.19
Skewness	0.97882	1.405788	-0.006908	0.756744	0.3486	1.3373
Kurtosis	2.412807	3.303258	1.284024	1.942615	2.5866	3.8304
Jarque-Bera	16.69175	31.98768	11.77906	13.63484	2.6280	14.3792
Probability	0.000237	0.000000	0.002768	0.001095	0.2687	0.0007
Sum	30,64859	9,382,023	57,943,734	14,299,507	201.6125	69160
Sum Sq. Dev.	1.10E+11	1.25E+12	4.49E+12	2.31E+12	5.9154	1.02E+12
Observations	96	96	96	96	96	96

Source: Research finding (2021).

Table 2. Result of Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	Level			First Difference		
	t-stat	critical value	p-values	t-stat	critical value	p-values
Log Return on Asset	-2.350	-3.5014	0.1586	-3.817	-3.5014	0.0396
Log Web Payment	-0.9078	-3.501	0.7818	-4.594	-3.5014	0.0003
Log Mobile Money Operators	-0.6266	-3.502	0.8585	-5.933	-3.5014	0.0000
Log Automated Teller Machine	-0.6140	-3.501	0.8614	-4.229	-3.5014	0.0010
Log Point of Sale Teller	-2.0644	-3.502	0.2595	-3.716	-3.5014	0.0053
Log Total Asset	-0.9634	-3.5014	0.1845	-3.657	-3.5014	0.0380

Source: Research finding (2021).

It reveals that the monthly average value of transactions completed through Web payment during the period under review was ₦31,925.62 billion with a minimum and maximum value of ₦2,276.46 billion and ₦103,497 billion respectively. Similarly, the monthly average value of transactions through Mobile Operators was ₦97, 729.4 billion with a minimum and maximum value of ₦2,297.7 billion and ₦377,265.2 billion respectively. Also, the monthly average value of transactions through ATM operations was ₦603,580.6 billion with a minimum and maximum value of ₦295, 416.7 billion, and ₦875,519.3 billion respectively. It further reveals that a monthly average value of ₦ 148,953.2 billion was completed through Point-of-Sale terminals with a minimum and maximum value of ₦2587.6 billion and ₦ 438,614.2 billion respectively.

The analysis thus, shows that based on the value of transactions, ATMs are the most popular technology followed by Point-of-Sale terminals, mobile operators, and web payments. The average mean return on assets of the banks is 2.10 percent. The variables data are not normally distributed based on their Jarque-Bera statistics and probability values ($P < 0.05$) in all cases except for the return on assets. The Augmented Dickey-Fuller test was conducted on the data to establish the nature of stationarity of each variable as presented in Table 2.

Table 2 shows the ADF results to test for the stationarity of the series at a level and first differences. The ADF tolerates mixed coefficients with a null hypothesis, which states that the data series trails a unit root process. To reject this assumption, the computed ADF probability value must be less than or equal to the 5% level of significance. The result shows that all the series are non-stationary at the level ($p > 0.05$) but stationary at the first difference ($p<0.05$).

Based on the result of the unit root test, it is relevant to check for the possibility of a long-run relationship among the selected variables. Thus, the Johansen cointegration test was employed to examine the existence or otherwise of the long-run relationship between emerging technology adoption and bank performance in Nigeria. The obtained results are presented in Table 3.

Table 3. Result of Johansen Cointegration Test

Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	126.2742	66.0854	33.8768	0.0000
At most 1*	60.18873	24.2925	21.5843	0.0248
At most 2*	35.89621	21.9511	20.1316	0.0383
At most 3	13.94510	8.6957	14.2646	0.3124
At most 4	5.249396	5.2493	3.8414	0.0219

Source: Research finding (2021).
Note: * Denotes rejection of the hypothesis at the 0.05 level.

Table 3 reveals that based on the significance of the values of the Trace statistics and Maximum Eigenvalue statistics there are three (3) co-integrating equations among the variables at a 5% level of significance. This implies that Web Payment, Mobile Money, ATM, POS, and Total Assets are co-integrated with ROA for a long-run dynamic regression analysis. Since the essential conditions for running the FMOLS have been fulfilled, data analysis was carried out using the FMOLS technique, and the result obtained is presented in Table 4.

Table 4. The Result of Fully Modified Least Squares Regression (FMOLS)

Dependent Variable: ROA				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Log Web Payment	3.2956	0.6483	5.0835	0.0000
Log Mobile Money Operators	1.7970	0.4588	3.9164	0.0002
Log Automated Teller Machine	4.1131	0.4237	9.7076	0.0000
Log Point of Sale Teller	1.3664	0.3551	3.8473	0.0002
Log Total Asset	2.4203	0.6096	3.9703	0.0328
C	27.2280	5.3240	5.1142	0.0000
R-squared	0.5625	Mean dependent var		2.0947
Adjusted R-squared	0.5098	S.D. dependent var		0.2429
S.E. of regression	0.1834	Sum squared residual		2.9954
Long-run variance	0.0426			

Source: Research finding (2021).

Table 4 reveals that all the specified variables for emerging technology payment systems have a positive and significant influence on bank profitability in Nigeria. Specifically, improvements in payment systems including Web payment (3.2956, $p < 0.05$), Mobile operators (1.797, $p < 0.05$), ATM (4.113, $p < 0.05$) and POS (1.3664, p

< 0.05) will result into increase in bank performance (profitability) in the long run. This implies that all the variables stated in this model contribute positively towards DMBs' financial performance and are significant at the 5% level.

Similarly, the coefficient of determination (R-square) value of 0.5625 shows that 56.25% of changes in financial performance are attributable to the adoption of emerging technologies such as Web Payment, Mobile Money, ATM, and POS at the firm level using Total Assets as a control variable.

5. Conclusion

The contemporary banking business has been revolutionized with the adoption and deployment of emerging technologies into various aspects of operations to compete favorably and meet teaming consumers' expectations. This study reveals that the adoption of emerging technology has a long-run positive influence on the financial performance of DMBs in Nigeria as it accounts for a sizeable proportion of their aggregate return on assets. Similarly, it shows that aside from the primary risk-taking activities that fetch interest income, emerging technology also contributes significantly to the performance of DMBs in Nigeria. The ATM and Web payment channels are the most popular, generating the largest volume of transactions among the emerging technology payment channels in Nigeria. Similarly, the study revealed that DMBs need emerging technology to reduce the incidence of switching among their customer due to the availability of desired technology in their current banks especially with the improved ATM connectivity and availability.

However, there is a need for clear regulation, supervision, and monitoring of these emerging technologies by government agencies and self-regulatory organizations to protect the depositor's funds from unscrupulous elements that can maliciously exploit the technological adoption to the detriment of the users and customers. This is essential to reduce cases and incidences of fraud and sharp practices that can discourage customers from using the emerging technologies deployed by banks.

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