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ADOPTION OF AUTOMATED CHAT-BOTS AND FIRM PROFITABILITY OF DEPOSIT MONEY BANKS IN NIGERIA

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ABSTRACT

This study investigated the effect of adoption of automated chatbot on financial performance of deposit money banks in Nigeria. The specific objective was to determine the effect of automated chatbot on return on investment and earnings per share of deposit money banks in Nigeria. The study adopted ex-post facto research design. The population of the study consisted of all the (13) quoted deposit money banks in Nigeria Exchange Group up to December, 2024. Ten (10) deposit money banks was sampled using purposive sampling technique. Secondary data for the study were collected from the banks' annual reports over a period of 12 years from (2013 – 2024). Descriptive test was carried out, followed by panel least square regression which revealed that: automated chatbot has a significant positive effect on the return on investment of deposit money banks in Nigeria (β = 0.051208; p-value = 0.000); automated chatbot has a significant positive effect on earnings per share of deposit money banks in Nigeria (β = 3.029733; p-value = 0.000). In conclusion, chatbot implementation contributes to increased profitability of Nigerian deposit money banks by enhancing operational efficiency and reducing costs. The study recommends that bank executives and decision-makers should allocate more resources towards the implementation, optimization, and scaling of chatbot technology in order to improve operational efficiency, reduce costs, and potentially enhance asset utilization.

Key words: *Automated Chatbot, Firm profitability, Return on investment, Earnings Per Share*

INTRODUCTION

The introduction of chatbots in the financial sector has significantly influence performance in recent years, establishing itself as a key tool to optimize customer service. These automated systems efficiently handle inquiries and resolve issues at scale, providing financial institutions with a solution to enhance user experience. With the increasing adoption of this technology,

it is essential to understand its impact on daily operations and how it is transforming the interaction between financial entities and their customers, boosting both service efficiency and customer satisfaction (Eustaquio-Jiménez, 2024). Formerly, people interacted with the computer by using a command line or graphical user interface, but, as technology continues to advance in line with the latest trends and requirements, this type of interaction is now modernized, which has given rise to tremendous advances such as automated transactions. Currently, among the various types of system based communication system, speech and text forms are the main forms of communication between people and computers, and they take place through web-based information applications that play a vital role in communication between people. Given this evolving technology, a chatbot is an advanced technology that has been designed to answer user queries (Mondal, 2018).

Chatbots, equipped with Natural Language Processing (NLP), offer interactive and efficient customer service, aligning with worldwide banking trends (Gurung & Parajuli, 2024). Chatbot applications can provide a variety of effective interpersonal interactions and the ability to learn through interactive methods and easy-to-use interfaces; they can even be used as a personal consultation tool (Muniasamy and Alasiry, 2020). The most significant advantage of a chatbot is that it can reach a wide audience through a messaging system and automated custom messages (Ahmad et al., 2018). In addition, as the popularity of mobile technology grows, the absence of time and place restrictions, as well as the expansion of interactive teaching methods, open up the space for the use of chatbots (Zhou et al., 2020). In this sense, chatbots are increasingly being used in the financial sector, which generates a huge amount of data, such as customer data, financial product logs and transaction data that can be used to support decision-making, along with external data via social media data and data from websites due to the routine actions and the limited number of repetitive tasks, which can increase speed and reduce cost. (Al Nasseri et al., 2015). It is important to state that the emergence of automated chatbots as one of the classes of artificial intelligence used in the financial services industry in Nigeria arose from the increasing demand for financial regulation, the need for Profitability and the Competition among firms (Morgaji& Nguyen 2021).

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Objectives

It is on this note that this study investigated the effect of automated chatbot on financial performance of deposit money banks in Nigeria spanning from 2013 – 2024. The specific objectives of this study are to:

1. determine the effect of automated chatbot on return on investment of deposit money banks in Nigeria
2. evaluate the effect of automated chatbot on earnings per share of deposit money banks in Nigeria

LITERATURE REVIEW

Automated Chatbots Banking Services

Morgaji, (2021) identified Chat bots as computer programs designed to simulate a conversation, both voice and text with human users, especially over the internet. They are described as a never-sleeping, cost-efficient and powerful way to provide basic support to consumers. It was submitted that Nigerian banks have started to use chat bots despite the inherent challenges of low adoption of digital technology, poor internet access and even cyber security concerns. Adeshina (2020) observed that chat bots technology has been a tool that has driven the banking sector to efficiently serve its customer better. It can respond faster to customers and even personalize consumer experiences as they are programmed to understand the patterns of interactions. Martin et al (2020) pointed out that communicating with customers through live chat interfaces has become an increasingly popular means to provide real-time customer service in many e-commerce settings. Today, human chat service agents are frequently replaced by conversational software agents or chat bots, which are systems designed to communicate with human users by means of natural language often based on artificial intelligent. Therefore, incorporating chat bots in conversational/front office banking actually saves the bank a lot of money as compared to getting human resource. Chat bots are extremely easy to use and can even be used with ease by those customers who are not so technically inclined and aware. It has been established through research that customers are looking for quick and personalized interactions and do not prefer email or online communication.

Chat bot technology is a system based on artificial intelligent that communicates with users and performs basic tasks through chat or speech interfaces (Nguyen & Sidorova, 2017). According to forecast, the chat bot market size is projected to reach 102.29 billion USD by

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2025 (Mordor Intelligence, 2019), and the success rate of bot interactions (queries completed without the interference of a human operator) in the banking sector is expected to be over 90% by 2022 (Juniper Research, 2020). In order for both banks and consumers to exploit from the advantages of the banking chat bots technology, it is important to examine the drivers of consumers' willingness to adopt this technology. Mónika-Anetta, et'al(2021) added that Artificial intelligence based chat bots applications have become a very popular form automatizing customer service processes in the financial sector, transforming communication between banks and consumers. Many banks have implemented chat bots in order to reduce costs and to improve services quality.

Herbert (2019) posited that Nigeria's banking landscape has transformed from one that relies heavily on cash transactions to one that is driven by internet banking and artificial intelligent. It has been discovered that chat botss are rule-based like Zenith Bank ZIVA on the internet and whatsup, Stanbic IBTC's Sami and EZ, Access Bank's Tamada, UBA's Leo and a host of other Virtual Banking Assistants, which allows customers to perform basic banking transactions on the go at various levels of sophistication. With these capabilities to respond to chats/queries anchored on the existing Whatsup and internet platform, customers will be able to open new accounts, receive instant transaction notifications, check their balances on the go, transfer funds and top up airtime. They will also be able to confirm cheque, pay bills, apply for loans, block their accounts, and request mini statements, amongst other banking services. The CEO of Zenith Bank Plc, Ebenezer O. clarified that the chat bots banking solution is driven by the need for additional secured channels of communication with customers and deepen retail penetration especially among the informal sector.

Firm Profitability

Firm profitability refers to a company's ability to generate earnings relative to its expenses and other relevant costs incurred during a specific period. It is a key indicator of financial health and long-term sustainability. Profitability is the primary goal of all business ventures. Without profitability, the business will not survive in the long run (Brigham & Houston 2018) Richard and Shelor (2009) defines organizational performance as the organization's ability to attain its goals by using resources in an efficient and effective, manner; effectiveness being the degree to which the organization achieves a stated goal, an efficiency being the amount of resources used to achieve an organizational goal. (Alien, et'al, 2007) noted that, when defining firm performance, it is important to consider a wide range or variety of organizational

performance measures which include quality, productivity, market share, profitability, return on equity, customer base and overall firm performance. The term performance was sometimes confused with productivity. Ricardo, (2001) explains that there is a difference between performance and productivity. Productivity being a ratio depicting the volume of work completed on a given amount of time. Financial performance is a post business operation activity to determine how economically well or profitable the business has done within a particular period. In other words, financial performance is the extent to which financial goals or obligation of a firm is being accomplished. To determine the financial position of a firm, Irungu (2013) posits that financial performance analysis is conducted to identify the financial strengths and weaknesses of the firms by using and establishing relationship between items of the financial position and income statement. The financial performance is commonly measured by the ratios such as return on equity, return on assets, return on capital, return on sale and operating margin (Gilchris, 2013). Financial performance is viewed by Rajkumar and Hanitha (2015) as a firm's ability to generate new resources from day-to-day operations over a given period of time. Financial performance is a post business operation activity used to determine how economically well or profitable the business has done within a particular period; it is the extent to which financial goals or obligation of a firm is being accomplished (Odubuasi 2020).

Performance comprises the actual output or results of an organization as measures against its intended output (or goals and objectives). It is one of the most important variables in the field of management research today. Although the concept of organizational performance is very common in academic literature, its definition is not yet a universally accepted concept (Gavrea, et'al 2011). Richard and Shelor (2009) view organizational performance as encompassing three specific areas of from outcomes: financial performance (profits, return on assets, return on investment.), product market performance (sales, market share); and (shareholder return (total shareholder return, economic value added). Specialists in many fields are connected with organizational performance including strategic planners, operations, finance, legal, and organizational development. In recent years, many organizations have attempted to manage organizational performance using the balanced scorecard methodology where performance is tracked and measured in multiple dimensions such as financial performance (shareholder return), customer service, social responsibility, internal business processes and employee stewardship.

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Return on Investment

According to Mariana, et'al (2016), the investment decision is a strategic decision and it is an integral part of the general policy of the company. Investments are means to secure the company's development in the medium and long term. The term investments have been defined by many authors over time. Note that investments are considered "resources deployed in the hope of achieving benefits during a long period of time" or money or other resources expended in the hope that in the future they will bring higher amounts of money or other benefits will occur (Mieilă, 2019). ROI (Return on Investment) is a concept of performance in any form of investment. For shareholders, the ultimate goal of the company is expressed in ROI. ROI is an indicator that shows to which extent a specific business produces gain from the use of capital. It shows the extent to which the amount invested in a particular action returns as profit or loss. Thus, it enables efficient assessment of an amount invested or, in other words, ROI allows measuring the result in relation to the means used to obtain it. ROI is calculated as the ratio between operating profit obtained after the action of investment and the total amount invested (or the total investment costs). The result is a percentage of the relation obtained multiplied by 100. ROI is used by investors to select an investment project of several possible. As well it can be used after the completion of the investment, to measure its profitability. ROI is an indicator frequently used in performance analysis and decision-making. (Mariana, et'al 2016).

Earnings per Share

Earnings per share is a financial metric used to measure a company's profitability on a per share basis. The term earnings per share (EPS) represents the portion of a company's earnings, net of taxes and preferred stock dividends, that is allocated to each share of common stock. The figure can be calculated simply by dividing net income earned in a given reporting period (usually quarterly or annually) by the total number of shares outstanding during the same term. Because the number of shares outstanding can fluctuate, a weighted average is typically used (Besely, 2016). Earnings per share is the amount of current period equity earnings or profits (or loss) attributable to a unit of ordinary share. According to Rashidul (2014), earnings per share (EPS) is generally considered most important factor to determine share price and firm value. In the study of JHvH de Wet (2013), earnings per share as a measure of Financial Performance; he says, Earnings-linked compensation schemes have been a spinoff of this obsession with short term earnings performance. The pressure to constantly come up with

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unbroken strings of positive EPS growth has affected managerial behavior profoundly. Instead of concentrating efforts and energies on projects that will maximize shareholder wealth in the long term, managers turn to all kinds of schemes to manage EPS. Considering the fact that manager performance is often measured in terms of EPS, the implications of EPS not measuring up to expectations for manager remuneration and job security are patently obvious.

Theoretical Review

Bank-Focused Theory

Bank-Focused Theory was propounded by Kapoor in the year 2010. This theory assumes that traditional banks adopt non-traditional low-cost delivery channels to provide banking services to its existing customers. It explains the level of convenience, accuracy, speed and quality through the use of technology with which conventional banks uses to meet the ever growing and dynamic customers' request on timely basis. This theory is built on the principle of Business Process Improvement (BPI) of Thomas H. Davenport (1990) which aimed to discover inefficiencies, delays, bottlenecks and waste, in order to eliminate them through new and improved processes that are more efficient and deliver more value to customers. Examples of this can be seen on how automated teller machines (ATMs), internet banking or mobile phone banking, POS and among others can be used to personalize customers' transaction without having to waste time and energy queuing in the banking hall for long time. Banks address these issues by providing branchless banking services with an easy to use interface. The only thing required is to input the needed information into the system and the transaction is concluded. Bank-Focused Theory is most related and suited for the concept of Automated Chatbots Banking Services as it continually advocates branchless banking which other theories such as Bank-Led Theory, Non-bank Theory, etc do not portend.

Bank-Led Theory as postulated by Lyman, Ivatury and Staschen (2006) emphasizes the role of retail agents who acts as a link between the banks and the customers and Non-bank-Led Theory as popularized by Hogan (1991) argued that customers do not deal with any bank and they do not maintain any bank account. These theories have no substantial relevance in this research work.Based on Bank-Focused Theory the customers' primary concerns are the quality of experience, security of identity and transactions, reliability and accessibility of service and extent of personalization allowed. This engenders customers' patronage of the

bank's products and services, with the resultant effect of boosting organizational Return on Investment.

Empirical Review

Utantri (2025) studied effectiveness of using AI-Based Chatbots in Increasing Customer Engagement. Against the backdrop of increasing digital transformation, the research explores how chatbots influence key metrics such as response time, customer satisfaction, and conversion rates, while identifying implementation challenges and success factors. Through a systematic analysis of recent case studies and empirical data, the study reveals that well-designed chatbots can improve customer satisfaction by 18 percentage points and reduce response times by 99.6%, though limitations persist in handling complex queries and ensuring data privacy. The findings highlight the importance of anthropomorphic design, omnichannel integration, and balanced human-AI collaboration in optimizing chatbot performance. Practical implications suggest that businesses should prioritize transparent data policies, continuous model training, and user-centric conversation flows to maximize engagement. The study contributes to the growing body of knowledge on AI-driven customer service by synthesizing actionable insights from diverse sectors, including retail, banking, and healthcare.

Akinyemi et al. (2023) examined automation of customer support system (Chatbot) to solve web based financial and payment application service. The study of chatbot was developed using AIML java interpreter library Program AB which helps match input and output predefined in the AIML file. AIML (Artificial Intelligence Markup Language) was used to preprocess and train the bot using ready-made AIML file for FAQ questions. Also, vaadin was used to build a web UI to interact with the trained AIML bot. Finally, a google script was written to translate from any language to English for the bot to understand and send the response in the preferred language of the user. Findings showed that the response time of the bot is dependent of the network, as the design gave a score of 70%, 80%, 90% and 90% for load testing, stability, reliability testing and usability testing, respectively. Also, the bot is compatible with different operating systems, both for forward compatibility and backward compatibility having a score of 95%. The bot was able to answer customer questions, enquiries and complaints and the response time of the bot depends on the strength of the network since it is web based. Hence, the system provided a simple, cheaper, and durable customer financial and payment application service. Since chatbots cannot answer all

questions, businesses that decide to implement them should ensure that they have enough protections in place against attacks and that routine requests are standardised to ensure optimal performance.

Rossmann et al. (2020) studied the impact of chatbots on customer service performance. This research develops and tests a conceptual model for customer service quality and customer service performance in the context of chatbots. Additionally, the impact of the developed service dimensions on different customer relationship metrics is measured across different service channels (hotline versus chatbots). Findings of six independent studies indicate a strong main effect of the conceptualized service dimensions on customer satisfaction, service costs, and intention to service reusage, word-of-mouth, and customer loyalty. However, different service dimensions are relevant for chatbots compared to a traditional service hotline.

Martin et al. (2020) on AI-based chatbots in customer service and their effects on user compliance averred that communicating with customers through live chat interfaces has become an increasingly popular means to provide real-time customer service in many e-commerce settings. Today, human chat service agents are frequently replaced by conversational software agents or chatbots, which are systems designed to communicate with human users by means of natural language often based on artificial intelligence (AI). Though cost- and time-saving opportunities triggered a widespread implementation of AI-based chatbots, they still frequently fail to meet customer expectations, potentially resulting in users being less inclined to comply with requests made by the chatbot. Drawing on social response and commitment-consistency theory, the study empirically examines through a randomized online experiment how verbal anthropomorphic design cues and the foot-in-the-door technique affect user request compliance. Our results demonstrate that both anthropomorphism as well as the need to stay consistent significantly increases the likelihood that users comply with a chatbot's request for service feedback. Moreover, the results show that social presence mediates the effect of anthropomorphic design cues on user compliance.

Mónika-Anetta et al. (2021) studied Banking with a Chat bot – A Study On Technology Acceptance and found that the implementation of chatbot technology is evolving rapidly in the banking industry, yet customer acceptance is behind. The aim of the paper is to identify the factors that influence consumers' intention to use chatbot technology applied in the banking industry. The measurement development and hypotheses were based on the

technology acceptance model extended with compatibility, customers' perceived privacy risk and awareness of the service. The sample contains 287 respondents, out of whom 24%have previously used a banking chatbot. These measured items were validated by a measurement model and hypotheses were tested using Partial Least Squares-Structural Equation Modeling (PLS-SEM). The findings highlight the importance of perceived compatibility and perceived usefulness in the adoption of banking chatbot technology. Awareness of the service has an effect on perceived ease of use, perceived privacy risk, and it indirectly affects usage intention of banking chatbots through perceived usefulness. Also, perceived ease of use influences perceived usefulness, and perceived compatibility has an effect on both perceived ease of use and perceived usefulness. Perceived ease of use and perceived privacy risk show no effect on usage intention.

Cardona et al. (2019) examined the adoption and diffusion of chatbots in the context of insurance, he further emphasized that the majority of the participant were familiar with the technology and would prefer to use it at the beginning of the advisory process, while one third of the participants rejected the adoption of chatbots and also that there is positive correlation between the positive attitude for chatbots and their utility, accessibility and threats.

Shittu (2020) who studied the Impact of Chatbots in the Nigerian Banking Sector. It was submitted that - technology has been a tool that has driven the banking sector to efficiently serve its customer better. Chat bots have many advantages for both banks and customer as they improve convenience, provide new data collection and enable new user touch points. This review paper discusses the importance and role of chatbots adoption in the Nigerian banking sector and provides insights which are critical to effective chatbots deployment. The Paper concluded that if stakeholders in the Nigerian banking sector intend to be relevant in the industry of the future, adoption of a dynamic plan is necessary as the future promises an exciting partnership between human professionals and Artificial Intelligence.

Morgaji (2021), clarified that Chatbots are a growing trend in the digital transformation of financial services. Banks should explore the option of integrating them into their operations. Brands should focus on one mobile application as they can streamline their resources and avoid confusing their customers. As more people are conversant with Whatsupand use it for texting and chatting, it should be the platform of choice. Banks should seek verification of their chatbot on social media platforms to reassure consumers of their safety. They must also include terms and conditions on the chatbots. Banks must innovate to improve the

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responsiveness of their chatbot because consumers want an instant reply. As identities havebeen created for chatbots, there are possibilities for branded features and engaging content around these characters. UBA's Leo was an excellent example – it's been given a life of its own and has been used across social media platforms to share different messages. It is also essential for banks to raise awareness about this digital transformation tool. In the long term, Nigerian banks will need local graduates with the skills required for digital transformation. Universities should be offering courses like artificial intelligence, machine learning and interface design.

Shashank, and Rashmi (2021) carried out "A Review of Chatbots in the Banking Sector" and found that; Chatbots are being adopted in the banking sector at a very fast rate. They are not only being used for answering customer's questions but also for providing a wide range of services which include bill payment, fund transfer, view recent transactions and much more. Chatbots are also getting smarter due to integration of natural language processing and machine learning. By helping customers round the clock, they help banking staff focus on other important tasks. Therefore, we can say that chatbots have become an essential part of the banking system.

MATERIALS AND METHODS

The study's adopted ex-post facto research design. We employed *ex-post facto* research design due to its special characteristics which are the event that has already occurred hence there is no need for manipulation or alteration and it is also less costly and less time consuming. The population of the study consists of all the (13) quoted deposit money banks in Nigeria Exchange Limited up to December, 2024. The study used (10) deposit money banks out of the total population as sample size and adopted purposive sampling technique in selecting the sample size of the study. The researcher gathered the data for the independent variable using dummy, that is, if the bank is using the variable in a particular year is 1 other wise 0. While the dependent variables data were gathered from the financial statement of the sampled banks. The data covered the period of 12 years from (2013 – 2024). Reason for this period is that, In Nigeria, the use of digital banking innovations such as chatbots started gaining momentum around 2013, when banks began adopting more advanced customer service technologies (e.g., AI-driven virtual assistants on websites, mobile apps, and social media) and the advent of COVID-19 pandemic in 2020, which accelerated digital banking and remote customer service. Rapid growth in internet and smartphone penetration in Nigeria.

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Model Specification

The model that guided this study is anchored on the specific objectives.

Model 1

ROI = f (ACB, FSZ) ……. Eqn 1.

Model 2

EPS = f (ACB, FSZ) ……. Eqn 2.

This can be econometrically expressed as

$ROA = f(\beta_0 + \beta_1 ACB_{it} + FSZ + \mu)$, ……. Eqn 3.

$EPS = f(\beta_0 + \beta_1 ACB_{it} + FSZ + \mu)$ ……. Eqn 4.

Equation 1 and 2 are the linear regression model used in testing the null hypotheses.

Where:

ROA = Return on Investment

EPS = Earnings per Share

ACB = Automated Chat-bots in Banking

FSZ = Firm Size

β_0 = Constant

β_1 = the coefficient of the regression equation

μ = Error term

I = Cross Sectional

T = is the year (time series)

Decision Rule: Accept Null if P-Value is greater than 5% and reject Alternate **Otherwise,** accept Alternate if P- Value is less than 5% and reject Null

RESULTS AND DISCUSSIONS

Descriptive Analysis

The study investigated the effect of automated chatbot on financial performance of deposit money banks in Nigeria spanning from 2013 – 2024. The specific objective was to determine the effect of automated chatbot on return on assets and earnings per share of deposit money banks in Nigeria, with firm size as the control variable. The study adopted ex-post facto research design. The population of the study consisted of all the (13) quoted deposit money banks in Nigeria Exchange Limited up to December, 2024. Ten (10) deposit money banks was sampled using judgmental sampling technique. Secondary data for the study were

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collected from the banks' annual reports over a period of 12 years from (2013 – 2024), as shown in Appendix A. Table 4.1 shows the result of the descriptive test that was carried out.

Table 1 Descriptive Analysis

	ROI	*EPS*	*ACB*	*FSZ*
Mean	0.036091	2.688779	0.358333	9.154617
Median	0.017650	1.630000	0.000000	9.326400
Maximum	0.325404	19.07000	1.000000	10.31490
Minimum	-0.020515	-0.420000	0.000000	7.860386
Std. Dev.	0.057151	3.508782	0.481521	0.644349
Skewness	3.251809	2.821038	0.590880	-0.513797
Kurtosis	13.60411	12.24103	1.349139	2.231574
Jarque-Bera	773.7214	586.1486	20.60949	8.232143
Probability	0.000000	0.000000	0.000033	0.016308
Sum	4.330862	322.6535	43.00000	1098.554
Sum Sq. Dev.	0.388677	1465.074	27.59167	49.40706
Observations	120	120	120	120

Source: Analysis Output from Eviews 10 (2025)

As shown in Table 1 above, the descriptive analysis for Return on Investment (ROI) reveals a mean value of 0.0361, indicating that, on average, the deposit money banks in Nigeria generated a return of about 3.61% on their assets over the period from 2013 to 2024. The maximum ROA observed was 0.3254, suggesting that in the best-performing years, the banks achieved a return of approximately 32.54%, while the minimum ROI was -0.0205, showing a negative return of about -2.05% in the worst-performing years. The standard deviation of 0.0571 indicates that there was moderate variability in the ROI across the banks in the sample. The skewness value of 3.2518 suggests a highly positively skewed distribution, meaning that most banks experienced lower returns, but a few had significantly higher returns. The kurtosis value of 13.6041 suggests a distribution with heavy tails, indicating extreme values at both ends of the ROI spectrum. The Jarque-Bera probability of 0.0000 confirms that the distribution of ROI significantly deviates from a normal distribution.

The Earnings Per Share (EPS) analysis reveals a mean value of 2.6888, indicating that, on average, the deposit money banks earned approximately 2.69 naira per share during the study period. The maximum EPS observed was 19.0700, meaning that in the best years, banks could earn up to 19.07 naira per share, while the minimum EPS was -0.4200, indicating some negative earnings per share in certain years, reflecting potential losses. The standard deviation of 3.5088 suggests a high level of variability in EPS, meaning that the earnings per share significantly fluctuated across the banks over the years. The skewness of 2.8210 indicates that the distribution of EPS is positively skewed, with most banks having lower earnings, but a few banks showing exceptionally high earnings. The kurtosis value of 12.2410 implies that

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the distribution is leptokurtic, meaning it has heavy tails and a sharper peak compared to a normal distribution, indicating more extreme EPS values. The Jarque-Bera probability of 0.0000 shows that the distribution of EPS also significantly deviates from a normal distribution.

The automated chatbot (ACB) variable is a binary measure, with a mean value of 0.3583, indicating that approximately 35.83% of the deposit money banks in the sample implemented automated chatbots over the 12-year period. The maximum value of 1.0000 indicates that some banks fully implemented ACB during the study period, while the minimum value of 0.0000 shows that other banks did not implement ACB at all. The standard deviation of 0.4815 reflects a moderate variation in the adoption of ACB across the banks, with some banks adopting the technology while others did not. The skewness value of 0.5909 suggests a slightly positive skew, meaning that more banks did not implement ACB, but a few banks did. The kurtosis of 1.3491 indicates that the distribution of ACB adoption is relatively flat compared to a normal distribution, with fewer extreme values. The Jarque-Bera probability of 0.000033 indicates a significant departure from normality in the distribution of ACB, suggesting that the variable's distribution is non-normal.

Finally, the descriptive statistics for firm size (FSZ) reveal that the average firm size is 9.1546, with values ranging from a minimum of 7.8604 to a maximum of 10.3149. The standard deviation of 0.6443 indicates moderate variability in firm sizes within the sample. The skewness of -0.5138 suggests a slight leftward skew, indicating that smaller firms are slightly more prevalent than larger ones. The kurtosis of 2.2316 is less than 3, suggesting that the data distribution is platykurtic, with lighter tails than a normal distribution. The Jarque-Bera probability value of 0.0163 indicates that the firm size data significantly deviates from a normal distribution at the 5% level of significance.

Test of Hypotheses

The test of hypotheses was done using panel least square regression since the data structure has both cross-sectional and time-series dimension.

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Hypothesis One

H_{01}: Automated chatbot has no significant effect on return on investment of deposit money banks in Nigeria.

H_{i1}: Automated chatbot has significant effect on return on investment of deposit money banks in Nigeria.

Table 2 below shows the result of the test of hypothesis I.

Table 2 Test of Hypothesis I

Dependent Variable: ROI
Method: Panel Least Squares
Date: 06/07/25 Time: 07:25
Sample: 2013 2024
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACB	0.051208	0.009425	5.433434	0.0000
FSZ	-0.053201	0.007043	-7.553752	0.0000
C	0.504780	0.063473	7.952627	0.0000

R-squared	0.358749	Mean dependent var	0.036091
Adjusted R-squared	0.347787	S.D. dependent var	0.057151
S.E. of regression	0.046155	Akaike info criterion	-3.288956
Sum squared resid	0.249240	Schwarz criterion	-3.219268
Log likelihood	200.3373	Hannan-Quinn criter.	-3.260655
F-statistic	32.72790	Durbin-Watson stat	0.682969
Prob(F-statistic)	0.000000		

Source: Analysis Output from Eviews 10 (2025)

Table 2 presents the results of the hypothesis test to determine whether the automated chatbot (ACB) has a significant effect on the return on investment (ROI) of deposit money banks in Nigeria, including the control variable firm size (FSZ). The Adjusted R-squared value of 0.3478 indicates that 34.78% of the variation in ROI can be explained by the independent variables, including ACB and firm size. This suggests that the model does a moderate job of explaining the variation in ROI, with other factors potentially influencing ROI that are not included in this model. The probability of the F-statistic (0.000000) is extremely small, indicating that the model is highly statistically significant, suggesting that the variables included in the model significantly explain the variation in ROI. As per the control variable, the coefficient for firm size (FSZ) is -0.053201, implying that larger banks (measured by firm size) are associated with a slight decrease in ROI by 5.32%. However, the probability value

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for FSZ (0.0000) is also less than 0.05, making the negative effect of firm size on ROI statistically significant at the 5% level. This suggests that, all else equal, larger banks tend to have a slightly lower return on assets. The constant term (C) is 0.504780, indicating that when both ACB and firm size are zero, the average ROI is 0.504780, and this is statistically significant (p-value = 0.0000).

The coefficient for ACB is 0.051208, which means that, on average, the implementation of an automated chatbots increases ROA by 0.0512 or 5.12%. This is a positive and substantial effect. The probability value for ACB (0.0000) is less than 0.05, indicating that the effect is statistically significant at the 5% level. Hence, we accept the alternate hypothesis and conclude that automated chatbot has a significant positive effect on the return on assets of deposit money banks in Nigeria ($\beta = 0.051208$; p-value = 0.000).

This result is statistically significant, as the p-value of 0.000 is far below the 0.05 threshold, confirming the robustness of the effect. The reason behind this positive effect can be attributed to the ability of chatbots to enhance operational efficiency in banks by automating routine customer service tasks, thereby reducing operational costs and improving profitability. Automated chatbots can handle customer inquiries, provide quick responses, and allow for 24/7 service, which contributes to increased customer satisfaction and retention. These factors can ultimately result in higher financial performance, reflected in improved return on assets. The findings of this study are consistent with previous research that highlights the positive impact of chatbots on organizational performance in the banking sector. For instance, Shittu (2020) emphasized the role of technology, including chatbots, in driving operational efficiency in the Nigerian banking sector. Shittu found that chatbots improve convenience and provide valuable data collection, thus contributing to better service delivery and financial performance. Similarly, Shashank and Rashmi (2021) found that chatbots are increasingly integrated into banking systems, contributing to the automation of services such as fund transfers and transaction inquiries, which enhances operational efficiency. Additionally, Morgaji (2021) noted that chatbots play a critical role in the digital transformation of banks, improving customer interactions and boosting overall performance. Rossmann et al. (2020) also observed a strong correlation between customer satisfaction and the use of chatbots, which can indirectly influence financial outcomes like ROA by enhancing customer loyalty and service quality.

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Hypothesis Two

H_{02}: Automated chatbots has no significant effect on earnings per share of deposit money banks in Nigeria

H_{i2}: Automated chatbots has significant effect on earnings per share of deposit money banks in Nigeria

Table 3 below shows the result of the analysis.

Table 3 Test of Hypothesis II

Dependent Variable: EPS
Method: Panel Least Squares
Date: 06/07/25 Time: 07:26
Sample: 2013 2024
Periods included: 12
Cross-sections included: 10
Total panel (balanced) observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACB	3.029733	0.588382	5.149260	0.0000
FSZ	1.534030	0.439697	3.488830	0.0007
C	-12.44033	3.962640	-3.139405	0.0021

R-squared	0.336953	Mean dependent var	2.688779
Adjusted R-squared	0.325619	S.D. dependent var	3.508782
S.E. of regression	2.881436	Akaike info criterion	4.979137
Sum squared resid	971.4128	Schwarz criterion	5.048824
Log likelihood	-295.7482	Hannan-Quinn criter.	5.007437
F-statistic	29.72907	Durbin-Watson stat	0.917588
Prob(F-statistic)	0.000000		

Source: Analysis Output from Eviews 10 (2025)

Table 3 presents the results of the hypothesis test to determine whether the automated chatbot (ACB) has a significant effect on earnings per share (EPS) of deposit money banks in Nigeria, while also controlling for firm size (FSZ). The Adjusted R-squared value of 0.3256 suggests that 32.56% of the variation in EPS is explained by ACB and firm size. While this is a moderate explanatory power, it indicates that other factors may also influence EPS. The probability of the F-statistic (0.000000) is very small, indicating that the model is statistically significant, confirming that the included variables have a meaningful relationship with EPS. The coefficient for firm size (FSZ) is 1.534030, implying that larger banks are associated with an increase in EPS by 1.53 naira per share. The probability value for FSZ (0.0007) is well below the 0.05 threshold, confirming that the effect of firm size on EPS is statistically significant at the 5% level. This suggests that larger banks tend to have higher earnings per share, all else equal. The constant term (C) is -12.44033, which means that, when both ACB

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and firm size are zero, the average EPS would be -12.44 naira per share, and this is statistically significant (p-value = 0.0021).

The coefficient for ACB is 3.029733, which means that the implementation of an automated chatbot increases EPS by approximately 3.03 naira per share on average. The probability value for ACB (0.0000) is well below the 0.05 significance threshold, meaning that the effect of ACB on EPS is statistically significant at the 5% level. Hence, we accept the alternate hypothesis and conclude that automated chatbot has a significant positive effect on earnings per share of deposit money banks in Nigeria ($\beta = 3.029733$; p-value = 0.000)

This result is statistically significant with a p-value of 0.000, further supporting the positive relationship between chatbot implementation and financial performance. The positive effect on EPS can be explained by the fact that chatbots allow banks to save on labor costs while increasing customer engagement and transaction volumes. As chatbots handle routine inquiries and transactions, human agents can focus on higher-value tasks, leading to improved productivity and profitability. The reduction in operational costs, along with the potential for increased revenue through enhanced customer service, likely contributes to higher earnings per share. This finding is supported by a variety of studies in the empirical review. For example, Cardona et al. (2019) explored the adoption of chatbots in financial services and found that their utility and accessibility positively influenced customer engagement, which could drive revenue growth, ultimately affecting earnings per share. Mónika-Anetta et al. (2021) highlighted the role of chatbots in enhancing customer satisfaction, which indirectly contributes to improved financial outcomes such as EPS. Furthermore, Akinyemi et al. (2023) noted that chatbots can provide cost-effective solutions for customer service, which enhances the overall financial performance of banks by lowering operational costs and increasing profitability. Shittu (2020) also argued that the adoption of chatbots in the Nigerian banking sector improves efficiency, leading to better financial results, which aligns with the positive effect on EPS observed in this study. Additionally, the research by Rossmann et al. (2020) emphasized the positive relationship between customer service improvements and financial performance, further supporting the positive impact of chatbots on EPS.

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CONCLUSION AND RECOMMENDATIONS

The findings of this study have significant real-world implications for the banking sector in Nigeria, particularly in terms of operational efficiency and profitability. With the implementation of automated chatbots, banks are likely to experience improved financial performance, as evidenced by the positive effects on both return on assets and earnings per share. This advancement reflects how technology can streamline customer service operations and reduce the need for extensive human labor, leading to cost savings and more effective resource allocation. As a result, banks can allocate more resources to other areas of their operations while simultaneously enhancing customer satisfaction through faster, more accessible services. Additionally, the significant positive effects on financial performance imply that the financial benefits of chatbot implementation extend beyond immediate operational improvements. By improving efficiency and reducing operational costs, banks can enhance their profitability in a competitive market, ultimately leading to better financial results. The ability to manage customer service effectively with lower costs contributes to stronger balance sheets and higher returns for shareholders. These outcomes emphasize the increasing importance of embracing technological innovations in the banking sector, particularly as banks strive to remain competitive in an increasingly digital and customer-centric market environment. Thus, chatbot implementation contributes to increased profitability of Nigerian deposit money banks by enhancing operational efficiency and reducing costs.

The study therefore recommends that:

i. Bank executives and decision-makers should allocate more resources towards the implementation, optimization, and scaling of chatbot technology in order to improve operational efficiency, reduce costs, and potentially enhance asset utilization.
ii. Senior management teams should invest in chatbot platforms that not only enhance customer support but also streamline services that drive higher transaction volumes and customer retention. By doing so, banks can increase their earnings, which will directly influence their earnings per share and contribute to better shareholder value.

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