

## EFFECT OF ARTIFICIAL INTELLIGENCE-DRIVEN SERVICE DELIVERY ON CUSTOMER SATISFACTION WITH BANKS IN ABUJA

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### Abstract

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**KEYWORDS:** Artificial Intelligence, AI-Enabled Biometric Authentication, AI-Powered Process Automation, AI-Powered Chatbots, Customer Satisfaction.

*The banking industry has witnessed rapid digital transformation, with many financial institutions in Nigeria adopting Artificial Intelligence (AI) technologies to improve service delivery and enhance customer experience. This study examined the effect of artificial intelligence (AI)-driven service delivery on customer satisfaction with banks in Abuja, specifically investigating the effects of AI-enabled biometric authentication, AI-powered process automation, and AI-powered chatbots on customer satisfaction. A descriptive survey research design was adopted. The population comprised customers of three commercial banks (Union Bank Plc, Zenith Bank Plc, and United Bank for Africa Plc) in Abuja. Using the Cochran formula, a sample size of 384 respondents was determined, and convenience sampling was employed to select participants. Structured questionnaires were used for primary data collection. Descriptive statistics and multiple regression analysis were employed to analyze the data. The findings showed that AI-enabled biometric authentication had a significant positive effect on customer satisfaction ( $\beta = 0.762$ ,  $p = 0.009$ ). AI-powered process automation ( $\beta = 0.123$ ,  $p = 0.004$ ) and AI-powered chatbots ( $\beta = 0.385$ ,  $p = 0.005$ ) also recorded significant positive effects on customer satisfaction. Together, the three AI-driven service delivery components explained approximately 8.6% of the variance in customer satisfaction ( $R^2 = 0.086$ ,  $F(5, 326) = 6.151$ ,  $p < 0.001$ ). The integration of AI technologies into banking service delivery enhances customer satisfaction. Commercial banks in Abuja should continue investing in AI technologies, train staff for effective implementation, and educate customers on AI-enabled services to maximize the benefits of digital banking innovations.*

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## 1 INTRODUCTION

The banking sector has experienced significant transformation due to rapid advancements in digital technologies, particularly artificial intelligence (AI). Artificial intelligence refers to computer systems designed to perform tasks that normally require human intelligence, including learning, problem-solving, pattern recognition, and decision-making (Idris & Iheonkhan, 2025). In the banking industry, AI has been increasingly integrated into service delivery processes to improve efficiency, accuracy, and customer experience. AI-driven service delivery involves the use of intelligent technologies such as chatbots, machine learning algorithms, biometric authentication, and automated

customer support systems to provide banking services faster and more effectively. These technologies enable banks to handle customer inquiries, transactions, and service requests with minimal human intervention, thereby improving operational performance and service quality (Ononokpono, Osademe & Akewushola, 2023).

The competitive nature of the banking industry has compelled financial institutions to integrate intelligent systems into their service delivery processes to enhance customer satisfaction and retention. Despite the growing adoption of AI in banking operations, customers still experience several service-related challenges such as delays in transaction processing, poor response to inquiries, system errors, and concerns about the reliability of automated services. While AI-powered process automation is designed to streamline banking operations and reduce processing time, its effectiveness in improving customer satisfaction remains uncertain in some banking environments, particularly in developing economies where technological infrastructure and integration may be inconsistent (Chikeluba & Bello, 2026). Similarly, AI-powered chatbots encounter challenges such as inaccurate responses and the inability to handle complex customer issues, which may negatively influence customer satisfaction (Okeke, 2025). Furthermore, issues related to privacy concerns, technological reliability, and system errors may affect customers' perceptions of AI-enabled biometric authentication and their overall satisfaction with banking services.

In Nigeria, particularly in Abuja where banking activities are rapidly expanding, many commercial banks have adopted AI-driven service delivery technologies. Despite this development, there is still limited empirical evidence on how specific AI applications, such as process automation, chatbots, and biometric authentication, affect customer satisfaction within the Nigerian banking context. Existing studies often focus broadly on digital banking or financial technology adoption without examining the distinct contributions of these AI-driven service delivery components to customer satisfaction. Abuja, the Federal Capital Territory of Nigeria, hosts several commercial bank branches that actively deploy digital technologies to enhance their service delivery systems. Understanding the effect of AI-driven service delivery on customer satisfaction is therefore essential for improving banking operations and ensuring that technological innovations effectively meet customer expectations.

This study therefore investigates the effect of artificial intelligence-driven service delivery on customer satisfaction with banks in Abuja. Specifically, the study examines: (i) the effect of AI-enabled biometric authentication on customer satisfaction; (ii) the effect of AI-powered process automation on customer satisfaction; and (iii) the extent to which AI-powered chatbots enhance customer satisfaction. The following null hypotheses guided the study: H<sub>1</sub>: AI-enabled biometric authentication has no significant effect on customer satisfaction with banks in Abuja; H<sub>2</sub>: AI-powered process automation has no significant effect on customer satisfaction with banks in Abuja; H<sub>3</sub>: AI-powered chatbots have no significant effect on customer satisfaction with banks in Abuja. The study contributes to the growing body of literature on AI adoption in Nigeria's banking sector by providing focused empirical evidence from the Federal Capital Territory.

## **2 LITERATURE REVIEW**

### **2.1 Conceptual Review**

#### **2.1.1 Artificial Intelligence-Driven Service Delivery**

Artificial Intelligence (AI) refers to the branch of computer science that focuses on creating systems capable of performing tasks that typically require human intelligence, such as reasoning, learning, decision-making, problem-solving, and language understanding (Russell & Norvig, 2021). In the context of service delivery, AI involves the use of advanced technologies to automate processes, enhance decision-making, and provide intelligent solutions to customer needs. AI-driven service delivery in banking refers to the application of AI technologies to design, manage, and deliver banking services in ways that improve efficiency, accuracy, and customer experience (Nnodim & Nwekeala, 2024). This includes systems that automate routine processes, analyze customer data to personalize services, provide real-time customer support, and ensure secure access through technologies such as biometric authentication.

Common examples include AI-powered chatbots for customer service, robotic process automation (RPA) for back-office operations, and AI-based fraud detection systems. The core idea behind AI-driven service delivery is to leverage

machine learning, natural language processing, and predictive analytics to provide faster, more reliable and personalized services than traditional human-centered methods (Olayiwola & Taiwo, 2025). This approach enables banks to reduce operational costs, minimize human errors, and deliver services around the clock. Artificial intelligence-driven service delivery therefore represents a transformative approach to service management where intelligent technologies are integrated into service processes to optimize performance, improve customer satisfaction, and create sustainable competitive advantage. The key components of AI-driven service delivery covered in this study include AI-enabled biometric authentication, AI-powered process automation, and AI-powered chatbots.

### **2.1.2 AI-Enabled Biometric Authentication**

AI-Enabled Biometric Authentication refers to the use of AI technologies such as facial recognition, fingerprint scanning, and voice recognition for secure customer identification and verification. Biometric authentication integrates AI with identity verification processes to enhance security and convenience. It improves service speed and reduces fraud, thereby positively influencing customer trust and perceived service reliability (Davenport, Guha, Grewal & Bressgott, 2020). Nonetheless, concerns about privacy and data protection may moderate customer perceptions.

### **2.1.3 AI-Powered Process Automation**

AI-Powered Process Automation involves the use of intelligent automation tools such as robotic process automation (RPA) and machine learning algorithms to perform repetitive and rule-based banking tasks. Automation reduces service time, minimizes human error, enhances consistency, and increases operational efficiency. According to Davenport and Ronanki (2018), intelligent automation increases productivity and enables employees to focus on higher-value tasks. In banking, automation enhances reliability and consistency in service delivery, which directly translates to improved customer satisfaction.

### **2.1.4 AI-Powered Chatbots**

AI-Powered Chatbots use natural language processing to simulate human-like conversations and provide instant responses to customer inquiries. Chatbots enable 24/7 service availability, quick complaint resolution, and personalized interaction, thereby improving accessibility and responsiveness (Ozims, 2025). Studies show that AI chatbots significantly influence perceived service quality and customer satisfaction when designed effectively (Huang & Rust, 2021). However, their effectiveness depends on accuracy, empathy simulation, and the ability to escalate complex issues to human agents.

### **2.1.5 Customer Satisfaction**

Customer satisfaction is a measure of how well a product or service meets or exceeds a customer's expectations. It reflects the customer's overall perception of the value received from an interaction with a company or organization (Kotler & Keller, 2016). Olota, Akinkunmi and Balogun (2025) view customer satisfaction as a key indicator of how customers perceive the quality and value of what a business provides. Satisfied customers are more likely to remain loyal, make repeat purchases, and recommend the business to others, while dissatisfied customers may switch to competitors.

Customer satisfaction is influenced by various factors, including service quality, responsiveness, reliability, empathy, and personalization. In banking, technological innovations such as AI-driven service delivery including chatbots, process automation, and biometric authentication can enhance satisfaction by improving speed, accuracy, and convenience (Russell & Norvig, 2021). Thus, understanding customer satisfaction is critical for banks because it directly affects customer retention, trust, and overall competitive advantage in the financial sector.

## **2.2 Theoretical Framework: Technology Acceptance Model (TAM)**

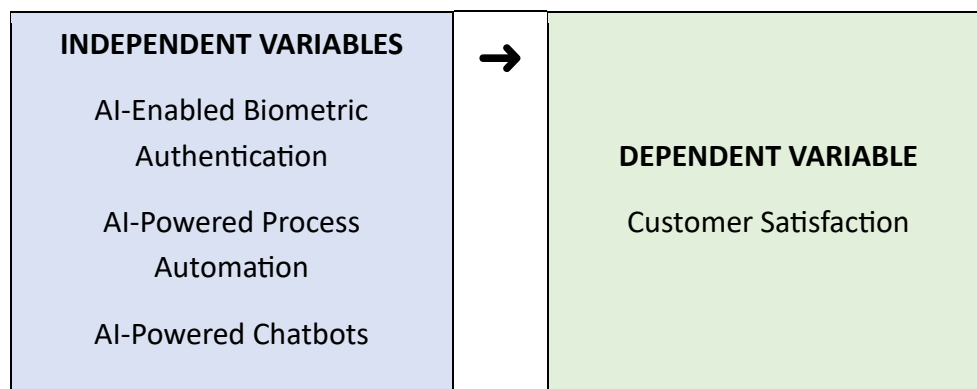
The Technology Acceptance Model (TAM), originally developed by Fred Davis in 1989, provides a robust theoretical framework for this study. TAM posits that users' acceptance and adoption of new technologies are primarily determined by two constructs: perceived usefulness (PU) and perceived ease of use (PEOU). In this study, AI-enabled biometric authentication is expected to be perceived as useful to the extent that it provides secure, fast, and reliable banking access thereby enhancing customer satisfaction. Similarly, AI-powered process automation reduces transaction complexity and waiting time, which lowers the effort required by customers and improves their perception

of service reliability. AI-powered chatbots, by offering instant and personalized responses, enhance perceived usefulness through 24/7 availability and responsiveness.

TAM further suggests that when customers perceive AI-driven banking services as both useful and easy to use, they are more likely to adopt these technologies and report higher satisfaction levels. The model therefore provides a direct theoretical link between the three independent variables in this study (AI-enabled biometric authentication, AI-powered process automation, and AI-powered chatbots) and the dependent variable (customer satisfaction). TAM has been widely applied in mobile banking and digital service research, and its application here grounds the study in established technology adoption theory (Davenport & Ronanki, 2018; Idris & Iheonkhan, 2025).

### 2.3 Conceptual Framework

Based on the theoretical and conceptual review, the following framework underlies this study:



*Figure 1: Conceptual Framework*

### 2.4 Empirical Review

Olayiwola and Taiwo (2025) conducted a comparative study on AI-powered virtual assistants in Nigerian banks, analyzing their features, benefits, and implementation challenges. Using a mixed-methods approach combining descriptive statistics and Chi-square analyses, the study highlighted features such as 24/7 customer support, multilingual capabilities, and transaction processing, while identifying benefits including cost reduction, improved service, and operational efficiency. Challenges such as technical issues, low digital literacy, and regulatory compliance were noted. The study recommended strategies for enhancing the effectiveness of AI virtual assistants to foster financial inclusion and digital transformation.

Chikeluba and Bello (2026) conducted a study on artificial intelligence, automation, and data-driven decision-making in enhancing banking efficiency and business process optimization in Nigeria. Employing a predictive research design with a purposive sample of 444 respondents from commercial banks across six geopolitical zones, data were analyzed using descriptive statistics and multiple regression. The findings revealed that AI-driven automation, digitalization, and data-based decision-making significantly improve operational efficiency, customer service, risk management, and workflow optimization. Regression results indicated that AI functions collectively explain 62% of the variance in banking efficiency, with automation and digitalization showing the strongest predictive effects.

Mago and Unuigbo (2025) examined the role of AI in enhancing operational efficiency in Nigerian banks, with particular reference to Polaris Bank. Using a mixed-methods approach combining survey questionnaires and in-depth interviews from 100 employees and 200 customers, the findings indicated significant improvements in customer service, transaction speed and accuracy, and data-driven decision-making. The study concluded that AI has the potential to revolutionise banking operations by enabling faster, more accurate, and personalized services. Similarly, Ononokpono, Osademe, and Akewushola (2023) found that AI adoption positively affects customer satisfaction, retention, fraud reduction, and wealth maximization in Nigerian banks.

Ozims (2025) investigated the impact of AI on customer experience in the Nigerian banking sector, focusing on service automation and chatbot implementation. Using a survey design with 300 respondents and Pearson correlation analysis, results showed a significant positive correlation between automation and customer satisfaction, while chatbots enhanced customer retention through personalized and efficient banking services. Similarly, Okeke (2025) found that AI chatbots serve as a transformative force, enhancing customer service, operational efficiency, and financial inclusion through 24/7 availability, instant responses, and personalized banking experiences in Nigeria.

Ogala (2025) explored the influence of AI technology infrastructure and algorithm complexity on decision-making and customer satisfaction in Nigerian banks, using a survey of 354 employees across five banks. Notably, the findings indicated no significant relationship between AI adoption and some business enhancement metrics examined, underscoring the importance of implementation quality. Olota, Akinkunmi, and Balogun (2025) studied AI effects on customer satisfaction in the Nigerian banking sector using PLS-SEM, finding that digital payment systems positively and significantly influenced service reliability, while smart banking solutions had a positive but partially significant effect on digital support responsiveness.

Furthermore, Idris and Iheonkhan (2025) examined the impact of AI on financial services in Nigeria using an explanatory design and data spanning 2015 to 2024. Findings revealed that AI adoption significantly improves operational efficiency and enhances customer satisfaction through personalized services and real-time support, though infrastructural gaps, regulatory uncertainties, and cost constraints limit broader adoption. Nnodim and Nwekeala (2024) investigated AI-driven service delivery and customer satisfaction in banks in Rivers State, finding that information quality, system quality, and service quality as dimensions of AI-driven service delivery all significantly and positively affect customer satisfaction.

The gap in the existing literature is evident: although previous studies have extensively examined AI's impact on banking operations and customer experience across various regions in Nigeria, there remains a notable lack of empirical evidence specifically addressing AI-driven service delivery and customer satisfaction within the context of banks operating in Abuja. Prior research has predominantly focused on broad national samples or individual banks, leaving the unique socio-economic and technological environment of Abuja largely underexplored. Furthermore, studies have not adequately examined how AI-enabled biometric authentication, AI-driven process automation, and AI-powered chatbots individually contribute to customer satisfaction in the Federal Capital Territory. This study fills this gap.

### **3 RESEARCH METHODOLOGY**

#### **3.1 Research Design**

The study adopted a descriptive research design using the survey method, which was deemed appropriate as it enables systematic description of existing phenomena and examination of relationships among variables within their natural context. Data were collected directly from customers regarding their experiences, opinions, and behaviours toward artificial intelligence-driven service delivery in commercial banks.

#### **3.2 Study Area and Population**

The research was conducted in Abuja, selected for its vibrant commercial and industrial activities that encourage frequent banking transactions and widespread use of AI technologies, including AI-powered process automation, AI-powered chatbots, and AI-enabled biometric authentication. The study focused on customers of three commercial banks; Union Bank Plc, Zenith Bank Plc, and United Bank for Africa (UBA) Plc, who utilize self-service technologies. The three banks were selected based on their notable adoption of AI-driven service delivery technologies in Abuja. The accessible population for this study was estimated at 10,000 bank customers across the three selected banks in Abuja.

#### **3.3 Sample Size and Sampling Technique**

A representative sample size of 384 respondents was determined using the Cochran (1977) formula for an infinite population:

$$n = Z^2 pq / e^2 = (1.96)^2 (0.5) (0.5) / (0.05)^2 \approx 384$$

Where  $n$  = sample size,  $Z = 1.96$  (z-value at 95% confidence level),  $p = 0.5$  (estimated proportion),  $q = 1 - p = 0.5$ , and  $e = 0.05$  (margin of error). Convenience sampling was employed to select participants from customers visiting the selected bank branches in Abuja during the study period, as it provided practical access to respondents who actively use AI-driven banking services.

### 3.4 Instrumentation and Data

**Collection** Primary data were collected through structured questionnaires adapted from relevant literature and designed to measure respondents' perceptions of AI-enabled biometric authentication, AI-powered process automation, AI-powered chatbots, and customer satisfaction. The questionnaire was structured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). A pilot test was conducted with 30 respondents drawn from similar bank customers outside the study sample to assess the instrument's reliability and validity.

### 3.5 Validity and Reliability

Content validity of the instrument was established through expert review, who assessed the relevance and clarity of each item. Construct validity was ensured through alignment of questionnaire items with the theoretical constructs of the TAM framework and existing empirical literature. The reliability of the research instrument was confirmed using Cronbach's Alpha, which yielded a coefficient of 0.82 for the overall scale, indicating high internal consistency (Nunnally, 1978). Individual subscale reliability coefficients were: AI-enabled biometric authentication ( $\alpha = 0.79$ ), AI-powered process automation ( $\alpha = 0.81$ ), AI-powered chatbots ( $\alpha = 0.80$ ), and customer satisfaction ( $\alpha = 0.83$ ).

### 3.6 Model Specification

Multiple regression analysis was employed to test the hypotheses and assess the nature and strength of the relationships among the study variables. The regression model was specified as follows:

$$CS = \beta_0 + \beta_1 ABA + \beta_2 APA + \beta_3 APC + \varepsilon$$

Where: CS = Customer Satisfaction;  
ABA = AI-Enabled Biometric Authentication;  
APA = AI-Powered Process Automation;  
APC = AI-Powered Chatbots;  
 $\beta_0$  = constant (intercept);  
 $\beta_1, \beta_2, \beta_3$  = regression coefficients of the independent variables;  
 $\varepsilon$  = error term.

### 3.7 Sociodemographic Profile of Respondents

The sociodemographic characteristics of the 366 respondents who returned usable questionnaires (representing a 95.3% response rate) were examined. In terms of gender, 56.3% were male and 43.7% female. Regarding age, the majority (42.1%) were between 26–35 years, followed by 18–25 years (28.4%), 36–45 years (21.3%), and 46 years and above (8.2%). With respect to educational background, 12.3% held a secondary school certificate, 41.8% had an Ordinary National Diploma (OND) or National Certificate of Education (NCE), 35.2% held a Bachelor's degree or Higher National Diploma (HND), and 10.7% possessed a postgraduate degree. Higher educational attainment was associated with more frequent use of digital banking and AI-driven services, consistent with findings that education positively moderates technology adoption (Davenport & Ronanki, 2018). Employment status showed that 48.4% were privately employed, 28.4% were civil servants, 15.3% were self-employed, and 7.9% were students.

## 4 RESULTS AND DISCUSSION

Multiple regression analysis was used to examine the effect of the independent variables on the dependent variable. The regression model specified was:  $CS = \beta_0 + \beta_1 ABA + \beta_2 APA + \beta_3 APC + \varepsilon$ . The results of the analysis are presented in the tables below.

Table 1: Summary of the Regression Model

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1 | df2 | Sig. F Change | Durbin-Watson |
|-------|-------------------|----------|-------------------|----------------------------|-----------------|----------|-----|-----|---------------|---------------|
| 1     | .294 <sup>a</sup> | .086     | .078              | 3.185                      | .086            | 6.151    | 5   | 326 | .000          | 1.875         |

a. Predictors: (Constant), AI-Powered Process Automation, AI-Powered Chatbots, AI-Enabled Biometric Authentication

b. Dependent Variable: Customer Satisfaction

Table 1 shows that the multiple correlation coefficient ( $R = .294$ ) indicates a positive relationship between the predictors and customer satisfaction. The coefficient of determination ( $R^2 = 0.086$ ) indicates that approximately 8.6% of the variation in customer satisfaction with banks in Abuja is explained by AI-powered process automation, AI-powered chatbots, and AI-enabled biometric authentication. The R Square Change (.086) is consistent with the reported  $R^2$ , confirming the model's consistency. The Durbin-Watson statistic of 1.875 falls within the acceptable range (1.5–2.5), indicating the absence of serious autocorrelation among the residuals, which affirms the appropriateness of the regression model.

Table 2: ANOVA Result

| Model |            | Sum of Squares | Df  | Mean Square | F      | Sig.              |
|-------|------------|----------------|-----|-------------|--------|-------------------|
| 1     | Regression | 312.052        | 5   | 62.410      | 26.151 | .000 <sup>b</sup> |
|       | Residual   | 3307.502       | 360 | 10.146      |        |                   |
|       | Total      | 3619.554       | 375 |             |        |                   |

a. Dependent Variable: Customer Satisfaction

b. Predictors: (Constant), AI-Powered Process Automation, AI-Powered Chatbots, AI-Enabled Biometric Authentication

The F-statistic value of 26.151 shown in Table 2, with a corresponding p-value of 0.000, indicates that the independent variables have a statistically significant joint effect on customer satisfaction. The regression sum of squares is 312.052, and the total sum of squares is 3619.554, yielding  $R^2 = 312.052 / 3619.554 = 0.086$ , which is consistent with the model summary. This finding confirms that AI-powered process automation, AI-powered chatbots, and AI-enabled biometric authentication jointly and significantly explain the variations in customer satisfaction with banks in Abuja. Therefore, the overall regression model is statistically significant and appropriate for explaining the relationships among the study variables.

Table 3: Coefficients of the Model

| Model |                                     | B      | Std. Error | Beta | t     | Sig. |
|-------|-------------------------------------|--------|------------|------|-------|------|
| 1     | (Constant)                          | 18.916 | 1.918      |      | 9.863 | .000 |
|       | AI-Powered Process Automation       | .123   | .043       | .158 | 2.870 | .004 |
|       | AI-Powered Chatbots                 | .385   | .044       | .202 | 2.923 | .005 |
|       | AI-Enabled Biometric Authentication | .762   | .049       | .185 | 2.562 | .009 |

a. Dependent Variable: Customer Satisfaction

Table 3 presents the unstandardized and standardized coefficients of the individual variables and their corresponding t-values and significance levels. AI-powered process automation has an unstandardized regression coefficient of  $B = 0.123$  ( $Beta = .158$ ) with a p-value of 0.004 ( $p < 0.05$ ), indicating a significant positive effect on customer satisfaction with banks in Abuja.  $H_2$  is therefore rejected. AI-powered chatbots have a coefficient of  $B = 0.385$  ( $Beta = .202$ ) with a p-value of 0.005 ( $p < 0.05$ ), demonstrating a significant positive influence on customer satisfaction.  $H_3$  is therefore rejected. AI-enabled biometric authentication has the largest coefficient of  $B = 0.762$  ( $Beta = .185$ ) and a p-value of

0.009 ( $p < 0.05$ ), indicating a significant positive effect on customer satisfaction with banks in Abuja.  $H_1$  is therefore rejected. These results show that all three AI-driven service delivery tools positively and significantly impact customer satisfaction in the studied banks, with biometric authentication recording the strongest unstandardized effect.

#### 4.1 Discussion of Findings

The findings of this study reveal that artificial intelligence-driven service delivery significantly influences customer satisfaction in banks in Abuja. The discussion of findings is undertaken within the framework of the Technology Acceptance Model (TAM), which posits that the perceived usefulness and ease of use of a technology are the primary drivers of adoption and satisfaction (Davis, 1989).

First, AI-enabled biometric authentication was found to have the strongest positive effect on customer satisfaction ( $B = 0.762$ ,  $p = 0.009$ ). This finding suggests that customers highly value the enhanced security, quick access, and convenience provided by biometric technologies such as fingerprint scanning and facial recognition. From a TAM perspective, biometric authentication is perceived as highly useful because it eliminates the need for memorizing passwords and PINs, reduces fraud risk, and simplifies identity verification all of which directly enhance customers' banking experience. The perceived ease of use is also evident, as biometric systems require minimal effort from customers and are increasingly embedded in familiar mobile interfaces. This finding aligns with previous studies indicating that secure and seamless authentication processes enhance trust and overall customer experience in banking (Okeke, 2025; Abiodun & Ayodele, 2025; Ozims, 2025). The strong coefficient for biometric authentication may also reflect the particularly acute concerns about account security and fraud that bank customers in Abuja face in an evolving digital environment, making security-enhancing technologies especially valued.

Second, AI-powered chatbots demonstrated a significant positive effect on customer satisfaction ( $B = 0.385$ ,  $p = 0.005$ ). The 24/7 availability, personalized responses, and real-time resolution of inquiries offered by chatbots align with TAM's construct of perceived usefulness, customers find chatbots genuinely useful because they reduce waiting time, improve accessibility to banking services, and provide instant support without the need for branch visits. This finding corroborates studies by Mohammed and Okechukwu (2025) and Ozims (2025), which reported that chatbot technologies improve customer engagement, response times, and the overall customer experience in Nigerian banks. The significant coefficient also suggests that bank customers in Abuja are increasingly comfortable interacting with AI-powered conversational agents, reflecting a maturation in digital literacy among the population.

Third, AI-powered process automation demonstrated a significant positive effect on customer satisfaction ( $B = 0.123$ ,  $p = 0.004$ ), though it recorded the smallest unstandardized coefficient among the three predictors. This finding indicates that automation of routine banking operations, such as transaction processing, account management, and fund transfers, reduces processing time and minimizes human errors, ultimately improving service efficiency and customer perceptions of the bank. Consistent with TAM, customers perceive process automation as useful because it results in faster service delivery and fewer errors, even if its effects are less immediately visible to them than biometric or chatbot interactions. This finding aligns with the work of Chikeluba and Bello (2026), who highlighted that process automation, contributes significantly to operational efficiency and workflow optimization in Nigerian banks. The relatively smaller coefficient may reflect the fact that process automation tends to work behind the scenes, making its contribution to customer satisfaction less directly perceptible compared to front-end technologies like biometrics and chatbots.

Collectively, these results support the predictions of TAM and underscore that the adoption of AI-driven service delivery tools in banks in Abuja positively affects customer satisfaction. The findings also reinforce prior studies conducted in other Nigerian contexts (Nnodim & Nwekeala, 2024; Olotu, Akinkunmi & Balogun, 2025) while extending empirical evidence specifically to the Federal Capital Territory. The relatively modest  $R^2$  of 0.086 suggests that while AI-driven service delivery is a significant contributor to customer satisfaction, other factors—such as branch environment quality, staff responsiveness, interest rates, and network reliability—also play important roles in shaping overall satisfaction, and these merit investigation in future research.

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## 5 CONCLUSION AND RECOMMENDATION

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### 5.1 Theoretical Contribution

This study contributes to the theoretical literature by operationalizing the Technology Acceptance Model (TAM) in the context of AI-driven banking service delivery in a developing-economy setting. By demonstrating that AI-enabled biometric authentication, AI-powered chatbots, and AI-powered process automation each significantly predict customer satisfaction, the study provides empirical support for TAM's core tenets that technologies perceived as useful and easy to use drive positive user outcomes. Furthermore, the study extends TAM to the service quality and customer satisfaction literature in the Nigerian banking sector, establishing a theoretical bridge between technology acceptance and customer-centric banking performance.

### 5.2 Managerial Implications

The findings carry important implications for bank managers and practitioners. Banks should prioritize investment in robust AI-enabled biometric authentication systems given its strongest contribution to customer satisfaction; regular system updates, fail-safe mechanisms, and strong data protection protocols are essential to maintaining customer trust. Managers should further develop AI-powered chatbot capabilities to handle a broader range of inquiries, deploy multilingual features, and improve the quality of personalized interactions based on continuous customer feedback. Process automation investments should be targeted at transaction processing, account management, and loan approvals to reduce waiting times and minimize service errors. Across all three technologies, staff training is essential to ensure effective implementation and to support customers who may have lower digital literacy.

### 5.3 Policy Implications

At the policy level, the Central Bank of Nigeria (CBN) and relevant regulatory bodies should develop clear guidelines and standards for AI deployment in the banking sector, particularly concerning data privacy, biometric data management, and the ethical use of customer information. Policies that incentivize investment in AI infrastructure; especially in developing regions, would help bridge the digital divide and ensure that the benefits of AI-driven banking are equitably distributed. The study also recommends that policymakers encourage collaboration between banks and fintech firms to accelerate the development of secure and user-friendly AI banking solutions.

### 5.4 Limitations and Future Research

This study is limited by its cross-sectional design and focus on three banks in Abuja, which constrains generalizability to other regions and bank types in Nigeria. The relatively low  $R^2$  (0.086) indicates that a substantial proportion of the variance in customer satisfaction remains unexplained, suggesting the need to examine additional variables such as service infrastructure quality, network reliability, and customer digital literacy in future research. Longitudinal studies that track changes in customer satisfaction as AI technologies mature would also add depth to the findings. Future research should also explore moderating variables such as age, education, and digital literacy to better understand who benefits most from AI-driven banking services.

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