

Digital Banking Technologies and Customer Satisfaction in Nigeria's Deposit Money Banks (DMBs): Evidence from Panel Data Analysis

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ABSTRACT

Customer satisfaction and loyalty have emerged as critical drivers of success in the highly competitive banking sector. However, the dynamic nature of customer preferences, rivalry from fintech companies and other non-traditional financial services, poor customer experiences and unresolved customers' complaints have heightened the challenges commercial banks face in retaining customers and ensuring their satisfaction. Therefore, this study investigates the effect of digital banking technologies on customer satisfaction in Nigeria's deposit money banks (DMBs). The study adopted ex-post facto research design. The population of the study consisted of 26 commercial banks in Nigeria, while 7 biggest banks in terms of customer base and customer complaints disclosure were purposively selected as the study's sample. The study employed secondary data sourced from annual reports of sampled banks between 2015 and 2023. The study employed pooled ordinary least square (POLS) regression method for the analysis. The results showed that: internet banking with ($\beta = 0.591$; p-value = 0.014) and POS banking with ($\beta = 1.069$; p-value = 0.015) have significant positive effect on customer satisfaction and loyalty; mobile banking with ($\beta = -1.093$; p-value = 0.028) has significant negative effect on customer satisfaction and loyalty; and ATM with ($\beta = -1.816$; p-value = 0.118) has insignificant negative effect on customer satisfaction and loyalty. The study concluded that internet banking, mobile banking and POS banking are major determinants of customer satisfaction in Nigeria. Therefore, the study recommended that commercial bank managers should improve mobile banking reliability, ensure regular maintenance of ATM to minimize cash shortages, and create easy channels for customers to provide feedback on digital services.

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1. INTRODUCTION

Globally, deposit money banks (DMBs) plays a pivotal role in the development of nations by creating employment opportunities for diverse groups, including managers, tellers, cleaners and security personnel, while fostering economic growth and development (Oje & Yua, 2024). DMBs are pivotal in facilitating transactions, providing credit and encouraging savings. The sustainability and advancement of DMBs depend significantly on the quality of services provided and the satisfaction of customers. In today's competitive environment, customer satisfaction remains one of the most crucial determinants of business success (Rao, 2024; Kaur & Soch, 2019). However, evolving customer preferences, increasing competition and technological advancements have intensified the challenges faced by DMBs in retaining customers and ensuring their satisfaction. Many banks continue to grapple with declining retention rates, poor customer experiences, and competition from fintech companies and other non-traditional financial service providers such as Opay, PalmPay, and Moniepoint (Fadaka & Azeez, 2020). Issues like transaction delays during money transfers and payments, malfunctioning Automated Teller Machines (ATMs), network downtimes, online fraud, hidden electronic banking costs such as SMS alerts, and the unavailability of financial services contribute to customer dissatisfaction (Mohammed, Bala, & Usman, 2024; Okechukwu, Nnabuko, & Okezie, 2023).

Moreover, long queues and overcrowded banking halls, especially near weekends, further frustrate customers. These issues are often attributed to network failures, inefficiencies among cash officers, and the inability of banks to provide reliable and customer-centric technological solutions (Chhatwal, 2024). Moreover, unresolved customer complaints and the lack of transactional assurance exacerbate customer dissatisfaction. In contrast, fintech companies prioritize seamless and user-friendly experiences, leveraging cost-effective, branchless operations to offer lower

fees and higher interest rates. The reliance on electronic banking has also led to numerous failed transactions. According to the Consumer Protection Department of the Central Bank of Nigeria, 35,453 cases of failed bank transactions were reported, with 33,437 resolved, resulting in refunds totaling ₦115.45 billion and \$22,794,184.87 to customers in 2022. Transaction delays, particularly with money transfers, remain a major issue (Mohammed, et al., 2024; Okechukwu, et al., 2023; Fadaka & Azeez, 2020). Customer complaints across five major Nigerian banks increased significantly in 2023, rising by 6,865,217 year-on-year from 3,156,704 complaints in 2022. Financial claims related to these complaints stood at ₦326.11 billion, a sharp increase from ₦83.78 billion in 2022. Data from the Nigerian Exchange Limited revealed notable increases in complaints for United Bank for Africa (UBA), Fidelity Bank, Access Holdings, and Zenith Bank Plc, while Guaranty Trust Holding Company (GTCO) was the only bank to report a decline (Mohammed, et al., 2024).

For instance, UBA recorded a 306.32% increase in complaints, rising to 1,930,518 in 2023 from 475,121 in 2022, with the disputed amount growing from ₦4.39 billion to ₦125.26 billion. Access Holdings saw complaints jump by 132.25%, from 1,387,702 to 3,222,907, with disputed amounts increasing from ₦57.87 billion to ₦136.75 billion. Fidelity Bank experienced a 77.69% rise in complaints, totaling 1,010,586 in 2023, with disputed claims growing by 268% to ₦55.20 billion. Zenith Bank saw complaints rise by 12.55% to 247,685, with disputed amounts appreciating by 66% to ₦8.38 billion. However, GTCO, however, reduced complaints by 10%, from 505,076 in 2022 to 453,575 in 2023, with disputed amounts dropping from ₦1.51 billion to ₦517.67 million (Mohammed, et al., 2024; Abimbola, 2023). In respect of the above problems, understanding the determinants of customer satisfaction and loyalty is crucial for maintaining competitiveness and achieving long-term profitability. Therefore, this study aims to identify the factors affecting customer satisfaction and loyalty in Nigeria, with a specific focus on digital banking services, including ATMs,

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POS terminals, internet banking, and mobile banking. By investigating these factors, the study seeks to provide actionable recommendations for improving digital banking experience, enhancing customer retention, and fostering customer satisfaction and loyalty in the banking industry.

Past studies such as Lolemo and Pandya (2024), Oje and Yua (2024), Adanlawo, Owolabi and Nkomo (2024), Rao and Sudhakar (2023), Barre and Warsame (2023), Kareem, Elkhaldi and Arfawi (2023), Okechukwu, Nnabuko and Okezie (2023), Harb, Thoumy and Yazbeck (2022), Rahuman, Akram and Siraji (2022), Anetoh, Okafor, Ewuzie and Okeke (2022), Albaity and Rahman (2021), Botirov, Nosiroy and Elmurodov (2021), employed primary data to measure customer satisfaction and loyalty which is often plagued with potential for bias and risk of inaccurate data. Surveys and interviews are susceptible to various forms of bias, such as response bias (where customers may give socially desirable answers rather than honest opinions), sampling bias (where the sample may not be representative of the entire customer base), and self-selection bias (where only certain types of customers participate in the study). These biases can distort the findings, leading to inaccurate or misleading conclusions about customer satisfaction and loyalty. Additionally, the accuracy of data obtained from primary sources can be compromised by factors such as misinterpretation of survey questions, recall bias (where customers may not accurately remember their experiences or feelings), and the subjectivity of responses as customers can exaggerate or underreport their level of satisfaction, affecting the reliability of the findings. Nonetheless, this study measured customer satisfaction and loyalty by total number of customers' complaints resolved by the banks. This metric reflects the bank's success in creating positive customer experiences through efficient problem resolution. Thus, the use of this secondary data allows the study to focus on actual outcomes, rather than relying on subjective customer perceptions, ensuring a more objective, accurate and data-driven measure of satisfaction and loyalty. Moreover, this approach enables the study to avoid the challenges of response fatigue or non-response common in survey-based research, thereby enhancing the overall validity and robustness of the findings.

2. LITERATURE REVIEW

Customer satisfaction is the degree to which customer expectations of a product or service are met or exceeded. It is a measure of how well a bank's products and services meet or exceed customer expectations. Satisfied customers are more likely to recommend friends and relatives to a particular service provider (Ahmed, 2023). Uwabor et al. (2021) explained that customer satisfaction comes from repeatedly assessing customer's experience with a product or service while using it. Here, satisfaction means the positive feelings customers have about a bank's electronic services based on their experiences (Santoso & Ibrahim, 2022). According to Santoso and Ibrahim (2022), customer satisfaction should go together with customer loyalty. A very satisfied customer tends to remain loyal for a longer time, buys more when new or better products are introduced, speak well of the company to others, ignore competitors, care less about price, suggest product or service ideas, and cost less to serve because their purchases become routine (Saputra, 2024; Nguyen, et al., 2024). In this study, customer satisfaction was measured by total number of customers' complaints resolved by the banks to provide an objective, data-driven measure of customer satisfaction and loyalty by directly assessing the bank's ability to address and resolve customer grievances. This is in contrast to past studies that employed primary data to measure customer satisfaction and loyalty, which is often plagued with potential bias and risk of inaccurate data. Internet banking, also known as web banking, involves conducting traditional banking activities over the Internet, utilizing the global network of computers without reliance on physical bank branches. It offers financial services accessible through the World Wide Web (www). Internet banking harnesses the capabilities of internet and telecommunication networks to seamlessly provide customers with a variety of banking services. Internet banking empowers customers to autonomously manage their financial affairs which ultimately results in enhanced user satisfaction. In this study, internet banking is measured by the total value of transactions done by customers using internet banking.

Mobile banking refers to the use of mobile devices, such as smartphones or tablets, to perform various banking activities and transactions remotely, involving the use of dedicated mobile banking applications provided by banks or financial institutions. Mobile banking allows customers to conduct financial transactions using their mobile phones, thereby eliminating the need for a physical bank visit. This convenience permits customers to manage transactions anytime, anywhere, thus, catering especially to busy individuals unable to visit branches. Moreover, mobile banking proves cost-effective for both banks and customers. Banks benefit from reduced operational expenses, while customers save on travel costs associated with branch visits. In this study, mobile banking is measured by the total value of transactions done by customers using the bank mobile app.

Automated Teller Machine (ATM) is an electronic banking device that enables customers to conduct various financial transactions without the need for human assistance or visiting a bank branch. Chukwu et al. (2021) described Automated Teller Machine (ATM) as electronic systems that let bank account holders make payments online or through other electronic devices. These systems reduce the need to carry physical cash by allowing customers to make payments in different currencies to businesses or people within and outside the country (Mohammed et al., 2024; Tewodros, 2020). In this study, ATM is measured by volume of transactions done by customers using the bank ATM. A point-of-sale terminal, commonly abbreviated as POS, typically consists of hardware and software components that facilitate transactions and manage sales data. POS system typically comprises a computer device connected to a barcode scanner and printer, running specialized POS software. According to this study Point of Sale (POS) is an electronic device that allow debit as well as credit transactions between two or more persons (Mohammed, et al., 2024; Uchechukwu & Stella, 2019). In this study, POS is measured by the total value of transactions done by customers using POS.

2.1 Theoretical Framework

The Technology Acceptance Model (TAM), developed by Fred Davis in 1989, is a widely used theoretical framework for understanding and predicting user acceptance and adoption of technology. TAM is rooted in the Theory of Reasoned Action (TRA) and focuses on the factors that influence an individual's decision to use technology. In digital banking, TAM provides a framework to explore how customers perceive and adopt services such as ATMs, POS, internet banking, and mobile banking. Customers are more likely to adopt digital banking services when they perceive significant benefits, such as reduced transaction times, 24/7 access, and enhanced convenience (e.g., banking from home). Adoption rates increase when digital platforms are intuitive, user-friendly, and require minimal effort to navigate. Features such as clear guidance or tutorials further enhance usability, encouraging customers to develop strong intentions to use these services and establish consistent usage patterns. This theory is particularly relevant for investigating the determinants of customer satisfaction as it identifies the psychological factors influencing adoption, satisfaction, and continued use of digital banking services. By leveraging TAM, banks can design and refine their digital platforms to align with customer expectations, ensuring ease of use and perceived value. Additionally, the model provides insights into barriers to adoption, such as poor usability or lack of perceived benefits, which can guide strategies to enhance the customer experience. Resolving customer complaints relates to the responsiveness and reliability dimensions of service quality, which directly impact customer satisfaction and retention. TAM posits that ease of use and perceived usefulness of internet banking, ATM, POS, and mobile banking directly influences user satisfaction by enhancing the efficiency and convenience of banking services.

Despite its utility, TAM has faced criticism for oversimplifying the adoption process. It primarily emphasizes cognitive factors, often neglecting emotional and social influences. The model does not explicitly address external variables such as trust, security concerns, or cultural factors, which are particularly critical in digital banking. Furthermore, TAM assumes a linear relationship between its constructs, which may not fully capture the complexities of human behavior. In summary, while TAM has limitations, it remains a foundational framework for understanding how digital banking influences customer satisfaction and loyalty.

2.2 Empirical Review

Fadaka and Azeez (2020) assessed the effects of service delivery quality on customer satisfaction among deposit money banks in Osun state, Nigeria. The results showed that 43.2% of the respondents were civil servants, majority were highly knowledgeable about deposit money banks services such as ATMs, electronic fund transfer (EFT), electronic bill payment (EBP), E-checke, Internet banking, mobile banking and debit cards, 68.8% perceived the quality-of-service delivery as average while 61.6% also rated the customer satisfaction as average. The test of hypothesis showed a positive and significant relationship between quality-of-service delivery and customer satisfaction. Botirov, Nosiroy, and Elmurodov (2021) studied what factors impact customer satisfaction in retail banking services in Uzbekistan. They found that customer satisfaction is affected by service quality, social benefits, trust, and the physical environment. The analysis showed that these four factors make up 72% of customer satisfaction. They also found a strong link between customer satisfaction and special treatment and easy access. The interest rates at all competing banks are similar because the central bank controls them.

Albaity and Rahman (2021) studied how different factors affect customer loyalty in Islamic banks, both directly and indirectly. The direct factors were satisfaction, attitude toward the bank, trust, and religious duty. The indirect factors were trust and attitude, which acted as mediators. They

used PLS-SEM methods to analyze customer loyalty. The findings showed that all the direct factors had a positive and significant impact, with trust and attitude being important in linking satisfaction, religious duty, and loyalty. In other words, satisfaction and religious duty influenced loyalty through these mediators. Abosede, Ariyo and Worimegbe (2021) examined the effect of innovation on bank efficiency and customers' satisfaction. They used data from the financial reports of five leading banks in Nigeria. The data was analyzed with regression and structural equation models. The study showed that service innovation greatly improves bank efficiency, which then impacts customer satisfaction. Innovation also has a direct effect on customer satisfaction. The study suggests that banks should invest more in innovation and use their resources well to ensure the best customer satisfaction.

Rahuman, Akram, and Siraji (2022) looked at what affects service quality and customer satisfaction. They gathered data from 275 customers in the Ampara district. The study showed that service quality and customer satisfaction are linked, with human-related factors having a bigger impact on satisfaction than non-human factors. The most important factors affecting customer satisfaction in state commercial banks were reliability and assurance. Harb, Thoumy, and Yazbeck (2022) explored how digital banking channels are adopted, their benefits, their effect on service quality, and how they influence customer satisfaction. The study looked at customer satisfaction with digital banking technologies in Lebanese banks during a time of instability in Lebanon. The results, analyzed using Spearman's correlations, showed strong links between customer satisfaction and the use of mobile banking, internet banking, transactional call centers, and ATMs. A multiple linear regression analysis also found that adopting digital banking channels positively impacts overall customer satisfaction in Lebanese banks. Dooty, Sultana, and Nahid (2022) wanted to understand how satisfied debit card users are and what affects their satisfaction with Islamic and conventional banks in Bangladesh, using a regression model. The study found that customers of conventional banks were more satisfied with the service quality compared to those of Islamic banks. In conventional banks, security and responsiveness were the main factors behind customer satisfaction, while in Islamic banks, the availability of money and transaction costs were less important for satisfaction.

Anetoh, Okafor, Ewuzie and Okeke (2022) investigated the influence of service quality dimensions on customer satisfaction of selected new generation banks in Anambra State, Nigeria, using Pearson correlation coefficient and multiple regression ANOVA. The findings showed that service reliability, service assurance, tangibility of service, empathy of service and service responsiveness had a significant and positive influence on customer satisfaction with bank services. Kareem, Elkhaldi and Arfawi (2023) studied the impact of electronic banking on customer satisfaction among 165 Iraqi Banks customers, using simple linear regression. The analysis found a strong connection between electronic banking services and customer satisfaction, based on factors like service quality, reliability, responsiveness, safety, and empathy. The results also showed that electronic banking services positively influence customer satisfaction. Barre and Warsame (2023) looked at how service quality impacts customer satisfaction and loyalty in Islamic banks in Somalia using a structural equation model (SEM). They discovered that factors like formality, reliability, sincerity, and tangibility positively affect customer satisfaction, while assurance and personalization have little impact. Also, when customer satisfaction mediates the relationship between service quality and loyalty, it strongly influences customer loyalty.

Rao and Sudhakar (2023) investigated the factors influencing loyalty switching among loan customers in private banks operating in Hyderabad, India. The research methodology involved comprehensive surveys and in-depth interviews conducted among a diverse sample of loan customers across various private banks in Hyderabad. Findings indicate that customer service quality and digital banking experiences significantly impact customer loyalty. Additionally, interest rates and convenience play pivotal roles in customer decision-making processes. The study provides valuable insights into the preferences and expectations of loan customers in private banks, shedding light on the areas that banks should focus on to enhance customer loyalty and retention efforts. Khashman (2023) explored what influences customer satisfaction in Jordan's banks. The study found that factors such as reliability, technology, assurance, responsiveness, employee skills, security, and privacy all improve customer satisfaction. It also highlighted that offering error-free services is important for increasing satisfaction and loyalty. Moreover, bank websites should have helpful information, and employees should offer good support while keeping customer data private. Okechukwu, Nnabuko and Okezie (2023) investigated the influence of customer relationship management on the satisfaction of commercial bank customers in southeast, Nigeria, using hierarchical multiple regression. The survey ascertained a statistical influence of customer orientation, CRM structure, and CRM technology on the satisfaction of commercial bank customers in Southeast, Nigeria. Commercial banks were advised to conduct monthly training on customer

value and celebrate the best customer caregiver of the year; decentralize customer relationship management to allow all departments to be deeply involved in the service of the customers; and offer incentives to encourage the use of customer relationship technology.

Oje and Yua (2024) looked at what influences customer satisfaction and loyalty in retail banking at the United Bank of Africa in Mozambique. They used frequency distributions, percentages, and multiple regression analysis in their study. The results showed that several factors affect customer loyalty and satisfaction with banking products. The study also found that the competitive environment doesn't have a big impact on satisfaction, but customer loyalty does vary with the seasons, which affects satisfaction with banking products. Nguyen, Ho and Ngo (2024) investigated how service innovation affects customer satisfaction and loyalty in Vietnam's banking sector. They looked at service innovation in three ways: new service ideas, new service processes, and new delivery technology. They used qualitative methods to create the survey and confirm the relationships between these factors. Then, they used structural equation modeling (SEM) to analyze the data. The study surveyed 398 customers of Vietnamese retail banks. The results showed that all types of service innovation, new ideas, processes, and technology, have a positive impact on customer satisfaction and loyalty. Furthermore, customer satisfaction plays a key role in increasing customer loyalty. Mohammed, Bala and Usman (2024) looked at how automated teller machines (ATMs) and point of sale (POS) systems influence customer satisfaction in deposit money banks. Since the study is based on previous research, it is a conceptual paper. The results showed that both ATMs and POS systems have a positive effect on customer satisfaction. The study concluded that good electronic banking services increase customer satisfaction in deposit money banks.

Adanlawo, Owolabi and Nkomo (2024) explored how technology affects customer service and satisfaction in Nigerian banks. The study found that using technology has a major impact on customer service and significantly improves customer satisfaction. Lolemo and Pandya (2024) reviewed 146 studies on how digital banking affects customer satisfaction and loyalty in commercial banks. The studies, published between 2006 and 2022, focused on topics like service quality, satisfaction, and loyalty, using both qualitative and quantitative research methods. The results showed that the number of studies published each year has been increasing, with most studies focusing on satisfaction, loyalty, and customer behavior. Descriptive research methods were used most often, while empirical studies were less common. More articles were published by male authors, and Pakistan and Nigeria had the highest number of papers. The findings suggest that commercial banks can improve customer satisfaction and loyalty by enhancing their digital banking services. Saputra (2024) looked at what factors influence customer satisfaction, loyalty, and trust in Islamic banks in Indonesia, using the SEM-PLS method. The findings showed that service performance, the quality of digital banking services, and customer relationship management all positively affect customer satisfaction. However, digital banking transformation does not impact customer satisfaction. Customer satisfaction also positively affects both loyalty and trust. It can act as a mediator between service performance, digital banking service quality, and customer relationship management, and loyalty and trust. But it does not mediate the effect of digital banking transformation on loyalty and trust.

3. METHODOLOGY

The research design employed in this study is ex post facto research design, which is suitable for analyzing historical data. The population of this study consists of 26 DMBs in Nigeria while the samples of the study consist of seven (7) DMBs in terms of customer base, customer complaints disclosure and data availability. The sampled DMBs include Access Bank, Fidelity Bank, Guaranty Trust Bank, United Bank for Africa, Unity Bank, WEMA Bank and Zenith Bank. Customer complaints data were sourced from annual reports of sampled banks on annual bases, while data relating to digital banking services were sourced from CBN statistical bulletin from 2015 to 2023. The mathematical representation of the a priori expectations is $\beta_1, \beta_2, \beta_3, \beta_4 > 0$. This study adapted the model used by Kareem, Elkhaldi and Arfawi (2023) in their study on electronic banking and customer satisfaction among Iraqi Banks customers. The simple regression model is specified as:

$$\text{Customer Satisfaction} = f(\text{Electronic Banking Services})(1)$$

Where, customer satisfaction was measured by tangibility, reliability, responsiveness, security and empathy; and electronic banking services was measured as single variable.

However, this study used secondary data to allow the study focus on actual outcomes, rather than relying on subjective customer perceptions. This is to ensure a more objective, accurate and data-driven measure of the determinants of customer satisfaction and loyalty. Hence, modifications were made to the model to integrate components of electronic banking such as internet banking, ATM, POS, and mobile banking.

Thus, the functional model for this study is specified as:

$$CSL = f(MOBB, INTB, POS, ATM)(2)$$

The model is further stated in econometric form as:

$$CSL_{it} = \beta_0 + \beta_1 MOBB_{it} + \beta_2 INTB_{it} + \beta_3 POS_{it} + \beta_4 ATM_{it} + \mu_{it} (3)$$

Where; CSL = customer satisfaction measured by total number of resolved complaints, MOBB = mobile banking measured by value of mobile banking transactions; INTB = internet banking measured by value of internet banking transactions; POS = POS measured by value of POS transactions; ATM = ATM measured by value of ATM transactions.

Descriptive and inferential statistics estimation techniques were employed. Pooled OLS (ordinary least squares) regression model was used as the estimating technique. Pooled OLS estimates the relationship between a dependent variable and one or more independent variables when dealing with panel data (data containing multiple entities observed over time). In this model, all the observations from all entities (cross-sectional units) are pooled together, and a single regression equation is estimated, assuming that the same relationship holds across all units.

The fixed effects show the relationship between the dependent variable and each of the independent variable based on the assumption that though the intercept may differ across the selected banks, each bank's intercept does not vary over time in order to reduce omitted variable bias. The random effects model (or error components model) reveals the relationship between the dependent variable and each of the independent variable based on the assumption that though intercept may differ across the selected banks, however each bank's intercept does vary over time. The Hausman Test assesses whether the assumptions of the random effects model hold. If they do not hold, the fixed effects model is preferred because it provides consistent estimates. In order to establish robustness, Breusch-Pagan Lagrange Multiplier Test was employed to confirm if a random effects model is even necessary over a pooled OLS model.

4. DISCUSSION OF RESULTS

4.1 Panel Summary Statistics

Panel summary statistics refers to the statistical summary of a dataset that is structured in panel form. A panel dataset consists of observations of multiple entities (firms) measured over multiple time periods. Panel data combines both cross-sectional data (data at a single point in time across entities) and time-series data (data over time for a single entity). Panel summary guides decisions on model specification, such as whether to use fixed effects, random effects, or other panel data econometric techniques.

Table 1: Panel Summary Statistics

Variable		Mean	Std. Dev.	Min	Max
Customer Satisfaction	overall	11.243	2.7433	4.8040	15.443
	between		1.8047	8.5697	13.687
	within		2.1653	7.4775	16.192
Internet Banking	overall	19.839	3.1241	15.892	23.803
	between		0	19.839	19.839
	within		3.1241	15.892	23.803
Mobile Banking	overall	19.532	1.6913	17.598	22.383
	between		0	19.532	19.532
	within		1.6913	17.598	22.383
POS	overall	20.070	1.8207	17.334	23.010
	between		3.84e-15	20.070	20.070
	within		1.8207	17.334	23.010
ATM	overall	20.684	0.4595	19.887	21.373
	between		0	20.684	20.684
	within		0.4595	19.887	21.373

Source: Author (2025)

Customer satisfaction tends to vary a lot over time, showing that it is influenced more by temporary factors than by constant differences between banks. This means that things like changes in service quality, or how efficiently the bank operates have a bigger effect on customer satisfaction than the basic differences between banks. For example, a bank's response to a sudden technical issue or its handling of a customer complaint could lead to sharp fluctuations in customer satisfaction, regardless of the bank's overall reputation. These time-sensitive factors are likely to shape customer sentiment more powerfully than the structural differences (reputation or size) between banks. Internet banking, mobile banking, POS and ATM usage is generally stable across different banks, meaning that users from various providers show similar patterns in how they adopt and use the service. However, within each bank, there is noticeable variation in usage over time, indicating that temporary or time-specific factors such as seasonal trends, promotions, technology updates, or shifts in customer preferences have a strong effect on how customers interact with internet banking, mobile banking, POS and ATM.

4.2 Panel Unit Root Tests

A panel unit root test is used to determine whether a time series data (across multiple cross-sectional units) is stationary or non-stationary in a panel dataset. In other words, it tests if a variable exhibits a unit root, which implies that its statistical properties (like mean and variance) change over time, and it does not revert to a long-term trend. Non-stationary data may lead to misleading or spurious results when used in econometric models, making unit root testing a necessary step. As such, Levin, Lin, and Chu (LLC) assume that the panel data has a common unit root process across all cross-sectional units, while Im, Pesaran, and Shin (IPS) allows for individual unit root processes across cross-sectional units. Im, Pesaran, and Shin (IPS) Test is more flexible than the LLC test, making it suitable for panels where individual differences are important.

Table 2: Panel Unit-Root Test

Variables	Im-Pesaran-Shin Test		Levin-Lin-Chu Test	
	Level	1 st Difference	Level	1 st Difference
CSL	2.211	8.735**	1.6343	7.094**
INB	1.784	7.2688**	-1.2262	-3.767**
MOB	2.935	5.8099**	1.373	7.4712**
POS	3.104	6.2210**	1.0169	-4.5235**
ATM	-0.19	4.198**	-2.5476**	5.3763**

Source: Author (2025)

Under the Im-Pesaran-Shin (IPS) test, the results on Table 2 showed that Customer Satisfaction, Internet Banking, Mobile Banking, POS (Point of Sale), and ATM were non-stationarity at level, but they all become stationary after first differencing. In addition, Customer Satisfaction, Internet Banking, Mobile Banking, and POS (Point of Sale) were non-stationarity at level, but they all become stationary after first differencing under the Im-Pesaran-Shin (IPS) test. However, ATM were found to be stationary at both level and first difference under the Levin-Lin-Chu (LLC) test. In summary, the results showed that the variables were have a mix of stationarity at level I(0) and first difference I(1).

Table 3: Hausman Tests and Lagrange Multiplier Tests for Random Effects

Variables	Hausman Tests		Lagrange Multiplier Tests for Random Effects		
	Random Effect	Fixed Effect		Cross-section	Time
INB	0.5907	0.5907	Breusch-Pagan	64.06	4.453
				(0.000)	(0.035)
MOB	-1.0931	-1.0931	Honda	8.0041	-2.1102
				(0.00)	(--)
POS	1.0689	1.0689	King-Wu	8.0041	-2.1102
				(0.00)	(--)
ATM	-1.8161	-1.8161	Standardized Honda	8.1984	-1.2467
				(0.00)	(--)
	Chi ² = 2.659	Chi ² = 5.495	Standardized King-Wu	8.1985	-1.2467
	Prob.> 0.347	Prob.> 0.139		(0.00)	(--)
					(0.001)

Source: Author (2025)

The pooled OLS regression, fixed and random effects model results were presented in Table 3. The results of Hausman Test in Table 4 showed that the probability values were 0.347 and 0.139 which suggest that the test did not reject the null hypothesis, indicating that the random effects model is appropriate. As such, the random effects model produced better estimates than the fixed effects model. Moreover, the Breusch-Pagan and related tests strongly indicate that random effects are present in the panel data model. This means that the random effects model is more appropriate than the fixed effects model. As a result, the study outputs were interpreted based on the pooled OLS result.

Table 4: Pooled OLS Regression Result

Variables	Customer Satisfaction <i>Pooled OLS</i>			Customer Satisfaction <i>Fixed Effect</i>			Customer Satisfaction <i>Random Effect</i>		
	Coef	t-Stat	Prob.	Coef	t-Stat	Prob.	Coef	t-Stat	Prob.
C	4.1749	1.4252	0.1616	4.1749	1.4252	0.1616	4.1749	1.4252	0.1616
INB	0.5907	2.5573	0.0135	0.5907	1.5487	0.1275	0.5907	1.5487	0.1275
MOB	-1.0931	-2.2133	0.0275	-1.0931	-1.628	0.1096	-1.0931	-1.628	0.1096
POS	1.0689	2.5646	0.0147	1.0689	2.5573	0.0135	1.0689	2.5573	0.0135
ATM	-1.8161	-1.588	0.1182	-1.8161	-1.588	0.1182	-1.8161	-1.588	0.1182
	R ² = 0.7029			R ² = 0.7029			R ² = 0.4959		
	F-stat = 11.6134			F-stat = 12.3063			F-stat = 14.2674		
	Prob(F-stat) = 0.0000			Prob(F-stat) = 0.0000			Prob(F-stat) = 0.0000		

Source: Author (2025)

5. DISCUSSION OF FINDINGS

The result in Table 3 showed that internet banking has significant positive effect on customer satisfaction and loyalty. This implies that customers who use internet banking may experience benefits like convenience, efficiency and accessibility, which directly enhance their satisfaction and encourage continued loyalty to the bank. This may be due to Internet banking allowing customers to perform transactions anytime and anywhere, saving time and effort. Quick processing of payments, transfers and other banking services improves the overall customer experience. Lower fees or costs associated with online banking might contribute to customer satisfaction. Advanced functionalities, such as bill payments, investment tracking, and account monitoring, create added value for customers. This finding is consistent with the findings of Kareem, Elkhaldi and Arfawi (2023) and Harb, Thoumy and Yazbeck (2022) which found that digital banking channel like Internet banking has a positive effect on customer satisfaction. Additionally, the finding aligns with the technology acceptance model (TAM) which suggests that customers may find internet banking highly useful. Features like convenience, time savings, and the ability to perform transactions remotely likely enhance satisfaction and loyalty. Customers' positive perception of internet banking aligns with TAM, where high PU and PEOU lead to greater acceptance, satisfaction, and loyalty.

In contrast, the result showed that mobile banking has significant negative effect on customer satisfaction and loyalty. This suggests that customers may be encountering challenges or dissatisfaction when using mobile banking services, which undermines their overall satisfaction and loyalty to the bank. This may be to frequent service disruptions, app crashes or slow transaction processing can frustrate users. Unexpected charges or fees associated with mobile banking transactions may leave customers dissatisfied. High expectations for seamless performance may not be met, leading to dissatisfaction. Perceived or actual risks related to fraud, phishing, or unauthorized transactions may erode customer trust. A complicated interface, lack of intuitive design, or limited functionality can make mobile banking less appealing. This finding contradicts the a priori expectation and the findings of Harb, Thoumy and Yazbeck (2022) and Fadaka and Azeez (2020) which found that mobile banking has a positive effect on customer satisfaction. In line with the technology acceptance model (TAM), customers may not find mobile banking as useful or reliable as expected. Issues like security concerns, hidden charges, frequent errors or network reliability may negatively influence customers' perceptions of mobile banking.

Furthermore, the result showed that POS banking has significant positive effect on customer satisfaction and loyalty. This implies that as customers use POS (Point of Sale) banking more frequently, their satisfaction and loyalty to the bank improve. This is an indication that POS banking is delivering value, convenience, and efficiency that resonate positively with customers. This may be due to POS banking provides an easy way for customers to conduct transactions without visiting the bank, saving time and effort. Fast and efficient processing of payments improves the overall customer experience. The widespread availability of POS terminals in retail stores, supermarkets, and other locations increases customer satisfaction by providing flexible payment options. Customers appreciate the convenience of cashless transactions, reducing the risks and inconveniences associated with carrying physical cash. This finding is consistent with the findings of Mohammed, Bala and Usman (2024) and Kareem, Elkhaldi and Arfawi (2023) which found that digital banking channel like Internet banking has a positive effect on customer satisfaction. Additionally, the finding aligns with the technology acceptance model (TAM) which posits that customers may find POS banking highly useful for cashless and seamless transactions at points of sale, enhancing convenience and flexibility. The straightforward nature of POS transactions likely contributes to a smooth and user-friendly experience, positively influencing satisfaction and loyalty.

In contrast, the result showed that ATM banking has insignificant negative effect on customer satisfaction and loyalty. This implies that ATM banking does not have a substantial effect on customer satisfaction and loyalty. As such, ATM banking usage is associated with a potential decrease in customer satisfaction and loyalty. Occasional issues such as out-of-service ATMs, long queues, or transaction failures might contribute to dissatisfaction, though not to a significant extent. ATMs offer a narrow range of services, such as balance inquiries, fund transfers, and mini-statements, apart from cash withdrawals. However, these functionalities may not be frequently utilized, reducing the ATM's effect on overall satisfaction. On the other hand, customers might increasingly prefer digital alternatives like mobile or internet banking, reducing their reliance on ATMs. This finding contradicts the a priori expectation and the findings of Mohammed, Bala and Usman (2024), and Harb, Thoumy and Yazbeck (2022) which found that ATM has a positive effect on customer satisfaction. In line with the technology acceptance model (TAM), customers may view ATMs as a standard and routine banking tool with limited added value. Issues like ATM downtime, cash shortages, or transaction failures might slightly detract from perceived ease of use, though not enough to have a significant impact.

6. CONCLUSION AND RECOMMENDATIONS

The study concludes that indicators of digital banking are the major determinants of customer satisfaction in Nigeria. Therefore, the study recommends that bank management should improve mobile banking reliability; ensure regular maintenance of ATM to minimize cash shortages; create easy channels for customers to provide feedback on digital services; and offer 24/7 customer supports such as live chat, email, and phone assistance for all digital banking channels, including Internet banking, mobile banking, POS and ATM to boost satisfaction and loyalty.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this manuscript.

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Author Contributions

All authors contributed significantly to the conception, design, data collection, analysis, and writing of the manuscript. All authors have read and approved the final version of the manuscript.

Informed Consent

Informed consent was obtained from all participants involved in this study prior to data collection.

Use of Generative AI

The authors confirm that generative AI tools were used only for minor language refinement and did not contribute to the intellectual content, analysis, or conclusions of the study.

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