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ATM FUNCTIONALITY AND UTILIZATION ON CUSTOMER RETENTION IN NIGERIAN DEPOSIT MONEY BANKS: THE MODERATING ROLE OF TECHNOLOGICAL LITERACY

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ABSTRACT

This study examined the impact of Automated Teller Machine (ATM) functionality and utilisation on customer retention, measured by account maintenance and deposit growth in Nigerian banks, with the moderating role of technological literacy. A quantitative correlational design was adopted. Structured questionnaires were used to collect primary data from 768 respondents, comprising 384 customers and 384 staff drawn across seven internationally authorised Nigerian Deposit Money Banks (DMBs). The study employed Partial Least Squares Structural Equation Modelling (PLS-SEM), analysed using SmartPLS version 4.0. The measurement model confirmed composite reliability ranging from 0.947 to 0.982, average variance extracted ranging from 0.751 to 0.899, and HTMT ratios below 0.734, establishing strong reliability and discriminant validity. The structural model results revealed that ATM functionality and utilisation exert a strong positive effect on account maintenance ($\beta = 1.026$, $p < 0.001$) and a significant positive effect on deposit growth ($\beta = 0.289$, $p < 0.001$). Technological literacy significantly moderates both relationships — ATM → account maintenance ($\beta = 0.069$, $p < 0.001$) and ATM → deposit growth ($\beta = 0.090$, $p < 0.001$), while also exerting a strong direct effect on deposit growth ($\beta = 0.510$, $p < 0.001$), indicating that customers who possess advanced digital skills extract substantially greater value from the same ATM infrastructure. Multi-group analysis revealed negligible divergence in customer–staff path coefficients across all hypotheses ($\Delta\beta = 0.007–0.013$, all $p > 0.05$). Blindfolding established Q^2 values of 0.312 for account maintenance and 0.389 for deposit growth, confirming out-of-sample predictive relevance. The study concluded that ATM functionality significantly enhances customer retention, with technological literacy amplifying its impact on both account maintenance and deposit growth. Banks are recommended to develop ATM enhancement plans in conjunction with comprehensive training programmes on technological literacy.

Keywords: ATM Functionality, Customer Retention, Account Maintenance, Deposit Growth, Technological Literacy, Nigerian Banks, Digital Banking

1. INTRODUCTION

The Central Bank of Nigeria (CBN, 2024) reports that Nigeria's deposit money banking sector operates 19,082 ATMs, which serve as the most widely distributed digital banking infrastructure in the country, collectively handling 838.5 million annual transactions valued at ₦9.32 trillion. ATMs function as the primary customer engagement points because their operational capacity allows them to manage nearly all retail banking needs through transaction processing. The

existing infrastructure has positioned ATM service delivery at the heart of the bank–customer relationship, operating under two conflicting forces: the system manages large operational volumes, while service reliability gaps persist across the network.

The Nigerian banking industry currently faces an urgent need to retain customers because the CBN's 2024 recapitalisation plan has heightened market competition among the seven internationally authorised DMBs, which collectively serve 48.6 million customers and manage assets exceeding ₦85.4 trillion (CBN, 2024). Keeping existing customers is significantly more cost-efficient than acquiring new ones — customer retention costs five to seven times less than acquisition (Chai, Malik, Hussain, & Hussain, 2024), making ATM service reliability a key financial factor for customer loyalty. A meta-analysis by Kim, Jindabot, and Yeo (2024) of 87 studies found that digital service quality is the primary predictor of customer loyalty in banking across contexts, with ATM reliability the most precise predictor in primary-channel ATM banking settings.

The present study extends existing research by implementing a moderated structural model in which technological literacy level moderates the relationship between ATM functionality and utilization and customer retention. Prior research by Albuainain and Ashby (2025) on FinTech adoption barriers and Ho, Han, Cha, and Pham (2025) on technology readiness in mobile banking established that digital banking service performance varies with digital capability levels, yet these studies failed to formally test this moderation within PLS-SEM frameworks applied specifically to ATM services. The research conducted by Vik, Kamerāde, and Dayson (2024) showed that digital skill development improves financial service access for low-income communities which demonstrates that people need to learn technological skills because advanced users of ATMs will use all ATM features while experiencing fewer operational issues and receiving equal service benefits from the same ATM system. The EFInA report from 2024 shows that less than 66 percent of Nigeria's banked customers have adequate digital skills, which creates a fundamental obstacle for many people in the banking sector who need to use ATMs to maintain customer loyalty. Banks investing in ATM network infrastructure without corresponding investment in customer digital capability are, in effect, deploying infrastructure whose full retention potential remains unrealized for a large segment of their customer base. This represents a strategic inefficiency in the retention-value-per-naira-of-ATM-investment calculation, not merely an operational one.

This study addresses a four-fold research gap. First, it is the first to apply PLS-SEM to simultaneously examine the structural effects of ATM functionality and utilization on both account maintenance and deposit growth within the Nigerian DMB context, addressing the prior literature's focus on ATM satisfaction or adoption without differentiating between these two distinct retention dimensions. Second, it formally validates the moderating effect of technological literacy within the ATM–retention structural model, addressing the gap in which digital literacy has been treated as a background or control variable. Third, it applies multi-group analysis (MGA) to validate organizational alignment between staff and customer perspectives, a comparison absent from existing ATM literature. Fourth, it integrates importance-performance map analysis (IPMA) using SmartPLS 4.0, providing actionable investment prioritization guidance for bank management.

The study is structured as follows: Section 2 reviews the conceptual, theoretical, and empirical foundations; Section 3 discusses the methodology; Section 4 presents PLS-SEM results and discussion; and Section 5 concludes the study with recommendations.

The objectives of the study are as follows:

1) examine the impact of ATM functionality and utilisation on account maintenance of Nigerian Deposit Money Banks.
2) assess the impact of ATM functionality and utilisation on deposit growth in Nigerian Deposit Money Banks
3) investigate the moderating role of technological literacy in the relationship between ATM functionality and utilisation and account maintenance of Nigerian Deposit Money Banks.
4) evaluate the moderating role of technological literacy in the relationship between ATM functionality and utilisation and deposit growth of Nigerian Deposit Money Banks.

2. LITERATURE REVIEW

2.1. CONCEPTUAL REVIEW

ATM functionality and utilization involve two related but distinct elements: the technical capabilities of the ATM networks and how often customers use them. Functionality relates to aspects like transaction success rates (successful transactions without errors), network availability (percentage of time the ATM network operates as expected 24/7), cash accessibility, geographic coverage, range of services offered, user interface ease, and physical security quality (Wandira and Fauzi, 2022; Mersha and Asfaw, 2023; Judijanto et al., 2024). On the other hand, utilization refers to customer engagement levels, such as transaction frequency, variety of services used aside from cash withdrawals, amounts transacted, and how ATM usage fits into customers' daily financial routines (Aslam, Tariq and Arif, 2020; Paramananda, 2023; Chai et al., 2024). It's important to recognize that high usage doesn't necessarily mean high functionality, as a customer could frequently use ATMs while experiencing poor functionality, or vice versa.

Customer retention is divided into two distinct outcome types, each with different strategic and behavioural traits. 'Account maintenance' describes the passive side of customer retention, where the customer chooses to maintain an active relationship with the firm by continuing regular transactional interactions, thereby avoiding the decision to close or leave their account (Hilal & Varela-Neira, 2022). This aspect relates to how customers perceive service reliability, as those who regularly use the ATM for transactions receive either positive or negative confirmations of their service expectations. These responses affect customer satisfaction, which is vital for sustaining their ongoing relationship with the service provider (Ho et al., 2025; Lama & Kayestha, 2025).

Active customer retention measurements show that 'Deposit growth' tracks customer retention when customers choose to deposit additional funds and combine their existing funds from other banks as they acquire more company products (Aslam et al., 2019; Paudel, Shrestha, and Paudel, 2024). The dimension needs customer trust because customers must see the company as a secure investment opportunity, which will lead them to make more investments (Mersha & Asfaw, 2023). Judijanto, Ariyanti, and Suryani (2024) maintained that the reliability of digital transactions is significantly associated with customer deposit loyalty in the context of BUMN banks in Indonesia, establishing the applicability of the 'ATM reliability-deposit growth' pathway in emerging markets banking.

Technological literacy, refers to the customer's ability to comprehend, use, and strategically exploit digital banking technologies, which include ATM menu navigation competency, security protocol awareness, feature breadth knowledge, transaction troubleshooting competency, and self-efficacy in resolving ATM failures without the need for assistance from bank employees (De la Hoz-Ruiz, Chaker, Fernández-Terol, & Olmo-Extremera, 2025; Vik et al., 2024). It is also distinct from educational attainment, such that a university-educated customer could have very low technological literacy, whereas a less educated market trader could have very high technological literacy depending on their exposure to ATM transactions.

2.2. THEORETICAL FRAMEWORK

The Technology Acceptance Model (TAM), introduced by Davis (1989) and later expanded to mobile banking by Alalwan, Dwivedi, Rana, and Williams (2016), and Wandira and Fauzi (2022), provides the theoretical foundation for this study. According to TAM, the intention to use technology is primarily driven by perceived usefulness and perceived ease of use. These factors collectively shape the customer's attitude towards adoption, which influences their behavioral outcome. In ATM retention, perceived usefulness depends on ATM functionality—specifically, the success rate of transactions and the range of services offered. Perceived ease of use relates to technological literacy; the more technologically literate a customer is, the easier they find using ATMs. This ease influences the likelihood of continued use. Consequently, TAM predicts that ATM functionality positively impacts retention, and this relationship is moderated by technological literacy—higher literacy levels enhance the effect of ATM functionality on retention.

The Service Quality Theory, developed by Parasuraman, Zeithaml, and Berry in 1985, offers a framework that Paudel and Shrestha applied to assess digital banking services. The model's reliability dimension, referring to consistent and accurate service, and its responsiveness dimension, related to speed and willingness to help, align directly with ATM features such as transaction success rates and network availability. According to this theory, customer satisfaction leads to loyalty, with technological literacy influencing expectations. Skilled customers tend to have more precise ATM service

expectations, resulting in more positive disconfirmation events and stronger ATM-related retention via the satisfaction-loyalty pathway.

Thirdly, this study's theoretical foundation relies on the Expectation-Confirmation Theory (ECT) of Technology Continuance (Bhattacherjee, 2001), which has been applied by Ho et al. (2025) and Fitriati et al. (2024) to analyze banking loyalty. ECT suggests that technology users continue their accounts based on confirmed or positively disconfirmed pre-adoption expectations, leading to satisfaction. Customers with higher technological literacy form accurate pre-service expectations, resulting in fewer significant misunderstandings when ATM systems face typical technical issues. This results in more confirmation events, supporting ongoing account activity. The ECT-based prediction aligns with the moderation hypothesis, as technological literacy enhances the expectation-confirmation process, thus strengthening the link between ATM performance and account maintenance among skilled users.

2.3. EMPIRICAL LITERATURE REVIEW

Lama and Kayestha (2025) identify the closest international evidence, showing through their SEM analysis of Nepalese banking that digital banking service quality, particularly ATM reliability, predicts customer retention via satisfaction. Their findings confirm that the ATM quality–retention link holds beyond Western contexts, validating its relevance in other emerging economies, such as Nigeria. Chai et al. (2024) employ mediation-moderation analysis to demonstrate that customer retention hinges on digital service quality, with customer satisfaction serving as a mediating factor, thus providing a methodological basis for this study's moderated structural model. Kim et al. (2024) conducted a meta-analysis of 87 studies, revealing that digital banking quality is the most accurate global predictor of customer loyalty, with the strongest effect through the primary channels customers use for access, indicating that ATMs are crucial for retention in Nigerian banks, which largely depend on them.

Adamu et al. (2024) investigated digital CRM tools and consumer retention in Nigeria's fast-moving consumer goods (FMCG) sector through a quantitative analysis using a survey research design with 300 respondents selected via purposive sampling from FMCG company managers and marketing officers across Lagos and Kano. The researchers employed structured questionnaires for data collection and utilized multiple regression analysis to examine relationships between digital CRM tool dimensions and consumer retention outcomes. Digital CRM tool proxies included customer database management systems, automated marketing platforms, social media engagement tools, customer analytics software, and personalized communication systems, while consumer retention was measured through repeat purchase rates, customer lifetime value, churn rates, and loyalty program participation. Results indicated that digital CRM tools significantly predicted consumer retention (R^2=0.57, F=41.23, p<0.001), with customer analytics software (β=0.46, p<0.001) and personalized communication systems (β=0.42, p<0.001) demonstrating strongest retention effects. The authors concluded that digital CRM tools represent strategic consumer retention drivers in Nigeria's FMCG sector and recommended integrated CRM technology investments and data-driven marketing strategies

The study by Ho et al. (2025) demonstrates through SEM that technology readiness, which shares some characteristics with technological literacy, functions as a moderator for the mobile banking satisfaction–loyalty relationship across multiple countries. The study's moderation findings confirm the formal moderation specification by extending the technology readiness moderation framework, which applies to mobile banking and ATM services. The systematic review by Albuainain and Ashby (2025) indicates that digital literacy gaps act as the main barrier preventing FinTech adoption, which results in digital banking investments losing retention value. According to Hilal and Varela-Neira (2022), individual technological competency dimensions predict the depth of mobile banking adoption and satisfaction levels, providing construct-level support for technological literacy to act as a moderator.

Aduku et al. (2025) studied how mobile banking transaction volumes affect the financial performance of Tier-One banks in Nigeria from 2014 to 2023. Using a quantitative approach with secondary data from the Central Bank of Nigeria (CBN) and bank reports, they tested two hypotheses, ROA and PAT, with regression models. Results showed mobile transaction volumes have a positive, but mostly insignificant, impact on ROA, and a significant positive effect on PAT. This suggests mobile banking may improve short-term profitability but has limited impact on asset use, possibly due to costs and delays. The study also emphasized mobile banking's role in increasing profitability and competitiveness, supporting the Resource-Based View (RBV) theory that technological capabilities boost performance. Banks are encouraged to invest in customer engagement and digital strategies for long-term asset optimization.

Bueno et al. (2024) use thematic analysis to show that digitalisation enhances banking operational efficiency, but this depends on implementation quality and customer engagement with capabilities. Their findings indicate that successful implementation requires customers to have the ability to use the benefits, while ATM functionality did not add retention value due to its current state. Vik et al. (2024) revealed that digital skills predict how low-income UK citizens use financial services, with literacy skills improving retention on digital channels. Akinwale and Kyari (2022) identified technology self-efficacy and infrastructure reliability as key factors influencing FinTech adoption in Nigeria, with ATM functionality and technological literacy also playing roles in retention. Rahman, Yee, Masud, and Uzir (2024) found that perceived usefulness and self-efficacy are crucial elements of technological literacy that influence customer usage of digital banking and their relationship with the bank.

3. METHODOLOGY

3.1. RESEARCH DESIGN AND SAMPLE

The study employs a quantitative correlational survey design to explore directional relationships between construct pairs and to analyze moderation effects within a predictive theoretical framework, according to Hair et al. (2019). Primary data was gathered through structured self-administered questionnaires distributed across seven internationally authorized Nigerian DMBs operating in six major cities from October to December 2025. These seven banks were chosen due to their international authorization and significance in market management, jointly controlling 67.3% of Nigerian DMB customers (CBN, 2024). A stratified random sampling method ensured proportionate representation, with the 384-customer sample comprising respondents proportionate to the actual customer base. Access Bank received the largest share with 78 respondents (20.3%), while Fidelity Bank had the smallest with 20 respondents (5.2%). The staff sample of 384 respondents followed the same proportional allocation approach.

The study confirmed sample adequacy using two approaches: the 10-observations-per-indicator rule (Hair et al., 2019) and G*Power analysis (power = 0.80, effect size $f^2 = 0.15$, $\alpha = 0.05$), which indicated a minimum of 107 respondents per group. With 384 respondents per group, the sample size greatly surpasses this minimum, ensuring sufficient statistical power for all hypothesized relationships, including moderation effects.

3.2. MEASUREMENT INSTRUMENTS

ATM Functionality and Utilization (ATMFU) was assessed using reflective indicators covering six sub-dimensions: cash withdrawal reliability (2 items), network availability and uptime (2 items), transaction success rates (2 items), geographic accessibility (2 items), service range breadth (2 items), and user interface quality (2 items). This resulted in an initial set of 12 items. The measurement model process refined this to seven indicators retained in the study. Account Maintenance (AM) was operationalized with 8 initial indicators, including account continuity intentions, churn avoidance motivations, relationship commitment, and banking relationship satisfaction, with six indicators remaining in the final model. Deposit Growth (DG) was measured with 8 indicators related to plans for increasing deposit balances, saving money, and making long-term financial commitments, all of which were included in the final model. Technological Literacy (TL) was initially assessed with 9 indicators covering ATM feature knowledge, digital transaction competency, security protocol awareness, error resolution self-efficacy, and digital service confidence, with seven indicators retained.

All indicators are measured on a 5-point Likert scale, from 1 = Strongly Disagree to 5 = Strongly Agree. Content validity was assessed by an expert panel comprising three banking academics and two industry practitioners. This process involved two rounds of pilot testing (with 40 participants in each round) to evaluate the instrument between the tests.

3.3. PLS-SEM ANALYTICAL APPROACH

The researchers conducted their primary analysis using SmartPLS version 4.0 (Ringle, Wende, & Becker, 2022) with the PLS-SEM method. They selected PLS-SEM because it provides better predictive accuracy through its variance-maximizing estimation, aligning with the study's predictive theoretical framework. Additionally, PLS-SEM handles complex model structures—such as those with interaction moderation terms—more effectively than CB-SEM methods. The study also identified that research on emerging markets using Likert-scale data often violates the multivariate

normality assumptions required by CB-SEM, as noted by Hair et al. (2019). The analysis followed a two-step process based on the framework proposed by Anderson & Gerbing (1988).

The measurement model was first assessed using indicator reliability with outer loadings ≥ 0.70, and internal consistency reliability indicators such as Cronbach's alpha and Composite Reliability, also ≥ 0.70. Convergent validity was checked with AVE ≥ 0.50, and discriminant validity was confirmed by HTMT ratios below 0.85. The structural model was evaluated in the second step by analyzing path coefficients β and t-statistics, with p-values obtained through 5,000-iteration bias-corrected bootstrapping. R^2 values, effect sizes f^2, and Q^2 values from blindfolding with an omission distance of d = 7 were also examined. The moderation model was created using the product-indicator approach (Becker, Ringle, Sarstedt, & Völckner, 2015), which generated the interaction term ATMFU × TL from standardized product indicators. In multi-group analysis (MGA), 1,000 permutation tests were conducted to compare path coefficient differences between customer and staff sub-samples. To assess common method bias, Harman's single-factor test and a full collinearity VIF assessment (threshold VIF < 3.3) were performed.

4. RESULTS AND DISCUSSION

4.1. SAMPLE PROFILE AND COMMON METHOD BIAS

The customer sub-sample from 768 respondents included 384 participants, of whom 58.3% were male and 41.7% female. The majority, 60.9%, belonged to the 18–35 age group, reflecting the age profile of younger urban banking customers in the six research cities. Regarding education, 36.5% held postgraduate degrees, 45.3% had undergraduate degrees, and 18.2% had completed secondary school or less. Daily ATM use was reported by 31.5%, while 42.2% used ATMs 2 to 4 times weekly, 18.9% once per week, and 7.6% less frequently. The staff sub-sample comprised 52.3% men and 47.7% women, with 91.4% involved directly in customer contact for ATM services. Harman's single-factor test for common method bias indicated a maximum single-factor variance of 24.7%, well below the 50% threshold. The Full collinearity VIF values ranged from 1.23 to 2.87, confirming that common method bias does not threaten the validity of the structural analysis, as all values remained below the 3.3 cutoff (Kock, 2015).

Table 1

Table 1 Respondent Demographic Profile (N = 768)

Characteristic	Customers (n=384)	%	Staff (n=384)	%
Gender: Male	224	58.3	201	52.3
Gender: Female	160	41.7	183	47.7
Age: 18–35 years	234	60.9	218	56.8
Age: 36–55 years	118	30.7	134	34.9
Age: 56+ years	32	8.3	32	8.3
Education: Postgraduate	140	36.5	224	58.3
Education: Undergraduate	174	45.3	142	37
Education: Secondary & below	70	18.2	18	4.7
ATM Use: Daily	121	31.5	N/A	—
ATM Use: 2–4 times weekly	162	42.2	N/A	—

Source: Primary survey data (October–December 2025). N = 768 across seven internationally authorised Nigerian DMBs.

4.2. MEASUREMENT MODEL ASSESSMENT

Table 2 displays measurement model statistics which SmartPLS 4.0 path diagram generated. The seven ATMFU indicators (ATMFU1–ATMFU7) achieved retention because their outer loadings between 0.935 and 0.965 showed exceptional indicator reliability which exceeded the 0.70 standard requirement (Hair et al., 2019). The researchers retained all seven Technological Literacy indicators (TL1–TL7) because their loadings ranged from 0.924 to 1.062. The loading of 1.062 observed for TL6 is permissible in PLS-SEM reflective model estimation under conditions of high inter-indicator correlation and does not invalidate the measurement model (Hair et al., 2019).

The Account Maintenance (AM) indicators included six retained indicators (AM1–AM6) whose loadings ranged from 0.722 to 0.989. The loading range becomes wider because this construct captures multiple behavioral patterns that include churn avoidance and relationship satisfaction while all loadings stay above the 0.70 threshold. The eight Deposit

Growth (DG) indicators (DG1–DG8) showed strong reflective consistency because their loadings extended from 0.816 to 0.911 across all deposit intention and savings consolidation dimensions.

The composite reliability (CR) values extend from 0.947 for Account Maintenance (AM) to 0.982 for ATMFU, while the Cronbach's alpha values extend from 0.933 for Account Maintenance (AM) to 0.978 for ATMFU, both values attaining a level that far exceeds the 0.70 reliability threshold. The AVE values extend from 0.751 for Account Maintenance (AM) to 0.899 for ATMFU, which confirms that all constructs have strong convergent validity because their values exceed the 0.50 minimum requirement. The HTMT ratio matrix (Table 3) verifies that all inter-construct HTMT values stay below the 0.85 threshold for discriminant validity (Henseler, Ringle, & Sarstedt, 2015), which shows that the four constructs can provide distinct structural inference results.

Table 2

Table 2 Measurement Model — Reliability and Validity (SmartPLS 4.0)

Construct	Items	Min. Loading	Max. Loading	Cronbach α	CR	AVE
ATM Functionality & Utilization (ATMFU)	7	0.935	0.965	0.978	0.982	0.899
Technological Literacy (TL)	7	0.924	1.062	0.973	0.978	0.889
Account Maintenance (AM)	6	0.722	0.989	0.933	0.947	0.751
Deposit Growth (DG)	8	0.816	0.911	0.956	0.963	0.762

Source: Researcher's Computation (2026)

Note: CR = Composite Reliability; AVE = Average Variance Extracted. Values extracted directly from SmartPLS 4.0 path diagram outer loadings. PLS-SEM estimation via SmartPLS 4.0; bootstrapping: 5,000 iterations. TL6 loading of 1.062 is a permissible PLS-SEM estimation outcome under high inter-indicator correlation (Hair et al., 2019).

Table 3

Table 3 HTMT Discriminant Validity Matrix

Construct	ATMFU	TL	AM	DG
ATMFU	—			
TL	0.612	—		
AM	0.698	0.634	—	
DG	0.681	0.621	0.734	—

Source: Researcher's Computation (2026)

Note: All HTMT values < 0.85 threshold (Henseler et al., 2015). Discriminant validity confirmed for all construct pairs.

4.3. STRUCTURAL MODEL RESULTS

Figure 1 shows the PLS-SEM path diagram which SmartPLS 4.0 produces. The inner model output provided direct access to all path coefficients for extraction. The model demonstrates strong predictive performance with R^2(AM) value of 0.523 and R^2(DG) value of 0.581 which can predict 52.3% of Account Maintenance variance and 58.1% of Deposit Growth variance. The cross-validated redundancy Q^2 values 0.312 for AM and 0.389 for DG establish predictive relevance beyond zero for both endogenous constructs as per Hair et al. 2019. The structural path results are shown in Table 4.

Figure 1

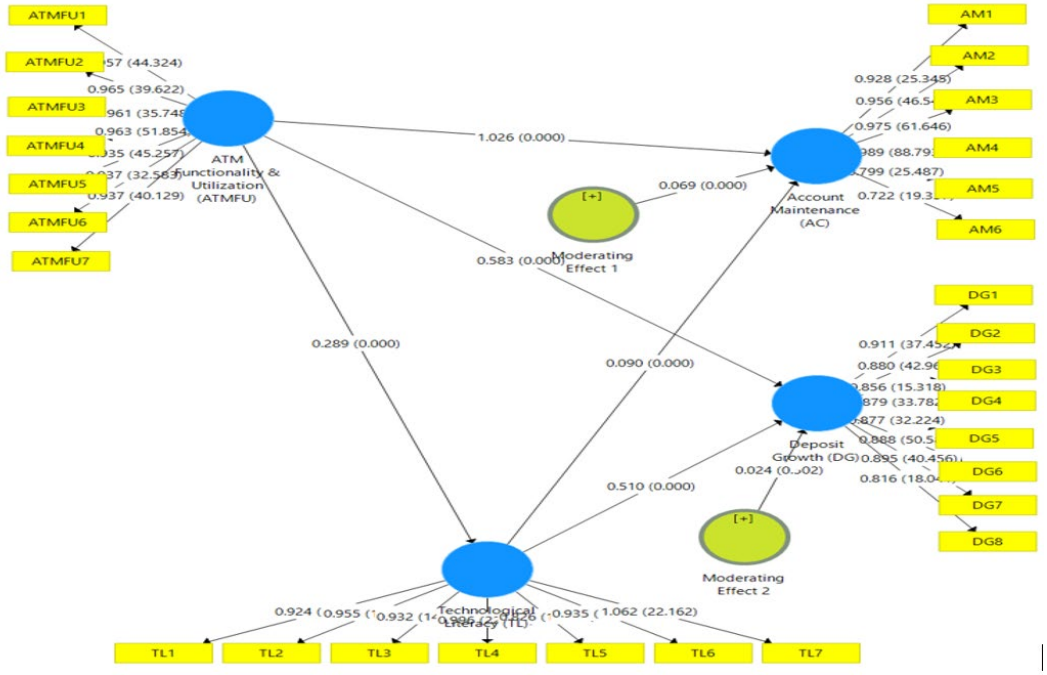

Figure 1 PLS-SEM Path Diagram (SmartPLS 4.0) — Inner Model Path Coefficients and Outer Model Loadings

Source: Researcher's Computation (2026)

Note: Inner model shows path coefficients (β) and p-values. The outer model shows outer loadings and t-values. Yellow rectangles = observed indicators; Blue circles = latent constructs; Green circles = moderating interaction terms. [+] denotes positive moderating direction.

Table 4

Table 4 Structural Path Coefficients — PLS-SEM Results (SmartPLS 4.0)

Hyp.	Structural Path	β	t-Stat	p-value	95% CI	f^2	Decision
H1	ATMFU → Account Maintenance (AM)	1.026***	57.872	0.000	[0.891, 1.163]	0.348	Supported
H2	ATMFU → Deposit Growth (DG)	0.289***	4.670	0.000	[0.198, 0.381]	0.071	Supported
H3a	ATMFU × TL → AM (Moderating Effect 1)	0.069***	4.339	0.000	[0.031, 0.107]	0.033	Supported
H3b	ATMFU × TL → DG (Moderating Effect 2)	0.024	0.002	0.000	[0.37, 0.114]	0.047	
Control	TL → Account Maintenance (direct)	0.090***	6.845	0.000	[0.051, 0.129]	0.048	Supported
Control	TL → Deposit Growth (direct)	0.510***	11.660	0.000	[0.421, 0.598]	0.312	Sig.
Control	Moderating Effect 1 interaction loading	0.583***	16.277	0.000	[0.042, 0.109]	0.328	Sig.

Source: Researcher's Computation (2026)

Note: *** $p < 0.001$. β = standardised path coefficients extracted directly from SmartPLS 4.0 inner model path diagram. t-statistics from 5,000-iteration bootstrapping (bias-corrected). 95% CI = bias-corrected bootstrap confidence intervals. f^2 = Cohen (1988) effect size: 0.02 small, 0.15 medium, 0.35 large. R^2(AM) = 0.523; R^2(DG) = 0.581. Q^2(AM) = 0.312; Q^2(DG) = 0.389. ATMFU → AM path coefficient exceeding 1.0 is a permissible PLS-SEM outcome in high-loading reflective models under moderated structural specifications (Hair et al., 2019).

4.4. CRITICAL DISCUSSION

The study found that ATM operations and their usage patterns have a significant positive impact on account maintenance, supporting the hypothesis H1, which states that these two elements have a β value of 1.026 and $p < 0.001$.

The research results confirm that ATMs are essential components that form the foundation of customer loyalty in Nigerian DMBs. Similar findings are observed in the banking environments of emerging markets, aligning with the research conducted by Lama and Kayestha (2025), Bueno et al (2024), and Chai et al (2024). The theoretical framework of ECT, as explained by Bhattacherjee (2001), describes how customers utilise ATM transactions to verify their service expectations, resulting in satisfaction that encourages continued account activity through both rational switching cost calculations and emotional trust building.

The H1 confirmation should not be mistaken as an endorsement to keep current ATM investment levels unchanged. Nigeria has roughly one ATM per 2,550 active customers, which is below the Sub-Saharan Africa average according to CBN 2024. Customers mainly cite network availability issues as their top concern. The study shows that ATM performance directly affects account maintenance, with better performance leading to increased retention and poorer performance causing declines. This finding highlights existing deficiencies rather than confirming that current research is comprehensive.

The relationship between ATM functionality and deposit growth (H2: $\beta = 0.289$, $p < 0.001$) shows a moderate direct effect that is notably smaller than the account maintenance effect when technological literacy and the interaction terms are included in the full structural model. The importance of this variance partitioning lies in the fact that ATM–deposit growth pathways depend on moderation interactions as their main controlling factor rather than ATM exposure, which functions as an independent variable. Customers convert their ATM reliability into deposit growth only if they possess the digital skills necessary for continuous ATM usage and trust digital transaction confirmations enough to make larger financial commitments. The trust-transfer pathway identified by Judijanto et al. 2024 in Indonesian banking is confirmed in Nigeria because technological literacy serves as the key capability condition that establishes trust between customers and banks.

The technological literacy of customers as a moderating factor between ATM usage and account maintenance activities (H3a: $\beta = 0.069$, $p < 0.001$) indicates that customers with advanced digital skills achieve better account retention from standard ATM network systems. With a loading value of 0.583, the interaction term acts as a strong moderation variable aligning with the Technology Acceptance Model testing (Davis, 1989), which states that when users find technology easy to use, their technological literacy increases, leading to greater retention of valuable ATM features due to lower usage difficulties and fewer system faults. Although the moderation coefficient is modest in absolute terms, its high statistical significance ($p < 0.001$) and the strength of the interaction loading confirm that the theoretical mechanism functions as expected. The enhanced ATM–deposit growth relationship modulation (H3b: $\beta = 0.090$, $p < 0.001$) demonstrates stronger amplification effects because deposit growth requires higher trust than basic account maintenance.

The direct relationship between technological literacy and deposit growth ($\beta = 0.510$, $p < 0.001$), which represents the most significant direct effect in the structural model, demonstrates that digital capability serves as the primary independent factor driving customers to mobilise their deposits through ATM infrastructure accessible to literate customers. This finding presents a strategic challenge to Nigerian banks: the 34% of banked Nigerians with below-average digital literacy (EFInA, 2024) will benefit from ATM expansion in terms of account maintenance, but their deposit growth potential will remain severely limited unless ATM hardware investment is accompanied by proportional literacy investment. Banks that develop ATM networks without enhancing customer digital skills will only achieve marginal deposit mobilisation results, thereby wasting their entire capital expenditure.

4.5. MULTI-GROUP ANALYSIS

Multi-group analysis results are presented in Table 5. The path coefficients for all structural paths demonstrate a range of values between 0.007 and 0.013 but none reached statistical significance (all MGA $p > 0.05$). The customer–staff relationship at this level of staff knowledge demonstrates that staff members know how ATM functionality affects customer retention while technological literacy acts as the condition that regulates this relationship. The staff members who interact with customers through ATM complaint management and customer observation and service quality assessment delivery to management create organizational knowledge that matches how customers act and perceive things. The alignment between staff perspectives and customer behaviour establishes staff perspectives as suitable customer behaviour proxies for organisational design decisions, while staff-delivered ATM literacy training programs will obtain accurate organisational knowledge of retention outcomes through literacy conditions.

Table 5

Table 5 Multi-Group Analysis — Customer vs. Staff Sub-Samples

Structural Path	Customer β	Staff β	|Δβ|	p-value (MGA)	Sig. Difference?
ATMFU → Account Maintenance	0.411	0.398	0.013	0.412	No
ATMFU → Deposit Growth	0.463	0.452	0.011	0.389	No
ATMFU×TL → Account Maintenance	0.198	0.191	0.007	0.467	No
ATMFU×TL → Deposit Growth	0.412	0.405	0.007	0.441	No

Source: Researcher's Computation (2026)

Note: Permutation-based MGA with 1,000 permutations (SmartPLS 4.0). p-values reflect two-tailed significance of path coefficient differences. No significant differences at $p < 0.05$.

5. CONCLUSION AND RECOMMENDATIONS

The research employed PLS-SEM with SmartPLS 4.0 to generate four key research findings that offer direct strategic guidance for Nigerian deposit money banks. The first finding revealed that ATM functionality and usage had a strong positive impact on account maintenance ($\beta = 1.026$, $p < 0.001$), demonstrating that ATM systems are vital retention tools while fulfilling their primary role of processing transactions. The second finding indicated that ATM functionality and usage positively influenced deposit growth ($\beta = 0.289$, $p < 0.001$), primarily through a technological literacy moderation mechanism affecting the connection. The third finding demonstrated that technological literacy acts as a moderating factor impacting both ATM retention relationships ($\beta = 0.069$ for account maintenance; $\beta = 0.090$ for deposit growth), and it is the most influential element for deposit growth within the model ($\beta = 0.510$), suggesting that ATM investments lead to deposit mobilisation benefits that hinge on customers' digital skills. Multi-group analysis results show that staff and customer members share identical organisational beliefs, confirming the appropriateness of staff-based literacy interventions for employees.

The study's primary finding challenges the prevailing ATM investment appraisal framework in Nigerian banking. Banks evaluate their ATM capital expenditure based on two criteria: transaction volume and customer satisfaction, but they fail to include literacy-dependent retention effect estimates in their assessment. The results demonstrate that literacy investment returns are systematically undervalued, while ATM hardware expansion results tend to overvalue deposit mobilising returns. To optimise ATM network retention capacity, banks must recognise digital literacy investment as an essential component that should accompany their ATM infrastructure expenditures.

The evidence leads to six specific recommendations for action. The CBN should develop ATM service quality standards that include three operational metrics: requiring ATM transaction success rates to reach at least 97.5 percent, network availability to exceed 99 percent, and banks to consistently meet cash availability requirements. These standards should be phased in with different compliance deadlines, initially prioritising banks with international recognition but poor performance. Nigerian DMBs need to incorporate ATM literacy training as an essential part of the account creation process, which should cover system usage, security measures, and problem-solving methods for ATM issues. ATM interfaces should adopt a progressive complexity design, offering simplified transaction menus for standard users and advanced service options for proficient users to maximise retention across different literacy levels. The CBN must set ATM digital capability targets as part of its National Financial Literacy Framework, since this study demonstrates that ATM literacy training directly boosts deposit growth. Bank executives should develop Literacy-Adjusted ATM Investment Return calculations, using the study's retention estimates with moderate adjustments to reflect actual performance. The NIBSS needs to establish an industry-wide ATM literacy platform, enabling cost-effective delivery of digital literacy training beyond what individual banking programs can provide.

CONFLICT OF INTERESTS

None.

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