



THE IMPACT OF CLOUD SERVICES, SECURITY AND SERVICES QUALITY ON CUSTOMERS LOYALTY: THE MEDIATING ROLE OF CUSTOMERS SATISFACTION WITH BANKING SERVICES

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ABSTRACT

This study aims to investigate the effects of Cloud Services, Security, and Service Quality: Mediating Role of Customer Satisfaction in Banking Loyalty. A cross-sectional survey was conducted involving 291 bank customers in Kaduna metropolis, utilizing a questionnaire with Likert-type questions for data collection, customers were randomly approached as they exited three major banks. Structural equation modelling was employed to analyze the proposed relationships. The measurement model shows that the convergent and discriminant validity were suitable for further analysis. The findings indicated that customer satisfaction has a significant positive impact on loyalty. Additionally, both cloud services and service quality directly and indirectly contribute to customer satisfaction with banking services. In contrast, the security of banking services does not have a direct or indirect effect on customer satisfaction. Overall, the results suggest that while all factors except security significantly influence satisfaction and loyalty, cloud banking services and service quality are crucial drivers of both loyalty and satisfaction. As competition in the Nigerian banking sector intensifies, banks should prioritize delivering exceptional service to enhance customer loyalty by ensuring that staff adhere to ethical standards in their interactions with customers.

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Introduction

Over the past decade, the global banking industry has undergone rapid digital transformation, driven by advancements in information and communication technologies. Innovations such as mobile banking, artificial intelligence (AI), data analytics, and automated customer service platforms have reshaped how banks deliver services, interact with customers, and manage internal operations. These technologies enable financial institutions to provide faster, more personalized, and more accessible services, thereby intensifying competition in the digital era. Empirical studies show that digital transformation initiatives particularly mobile and automated services significantly enhance customer satisfaction by improving service quality, convenience, and responsiveness (Li et al., 2021; Kumar et al., 2023).

At the center of this transformation is cloud computing, which has redefined how banks, process, and access data. Cloud-based infrastructures provide flexibility, scalability, and cost efficiency, allowing banks to deploy new services rapidly and respond to changing customer expectations. Cloud computing also supports real-time analytics, improved system integration, and enhanced operational resilience. As a result, banks increasingly rely on cloud solutions to modernize legacy systems, reduce operational costs, and compete with agile fintech firms (Awadallah, 2016; Kanchepu, 2023; Li et al., 2021).

In emerging markets, particularly across Africa, cloud computing plays a strategic role in promoting financial inclusion and expanding digital banking services. The continent's large unbanked population, infrastructural constraints, and geographic dispersion make cloud-based solutions attractive for delivering accessible financial services. Empirical evidence indicates that digital banking technologies improve customer satisfaction when they offer convenience, reliability, and strong security features (Kumar et al., 2023). However, as financial services become increasingly digital and cloud-dependent, concerns about cybersecurity, system reliability, and data privacy have

intensified. Studies reveal that information quality, service quality, and security systems significantly influence customer satisfaction in digital banking environments (Hammoud et al., 2018; Oni et al., 2016).

In Nigeria, the banking sector has experienced rapid growth in digital and cloud-enabled services, driven by increased smartphone penetration, regulatory support for cashless policies, and competition from fintech firms. Empirical studies in Nigeria show that digital banking adoption significantly enhances customer satisfaction, particularly when services are secure, reliable, and easy to use (Oni et al., 2016; Hammoud et al., 2018). More recent evidence also indicates that customer trust, perceived service quality, and convenience jointly shape satisfaction in digital banking environments (Kumar et al., 2023). Furthermore, research on digital security perceptions suggests that customers' confidence in banks' security protocols directly contributes to satisfaction and continued use of digital services (Li et al., 2021).

Despite these developments, concerns about data security, system reliability, and service responsiveness remain key determinants of customer loyalty in the banking sector. Empirical evidence indicates that reliability, security, efficiency, and responsiveness significantly influence customer satisfaction and loyalty in digital banking environments (Hammoud, Bizri, & El Baba, 2018; Andria, Roslina, & Fihartini, 2026). Similarly, research across different banking contexts shows that core service-quality dimensions such as reliability, assurance, responsiveness, and empathy have a significant positive effect on customer loyalty (Al-Wishah et al., 2022; Ullah & Haider, 2023). In the Nigerian context, studies also confirm that service quality is a major driver of customer satisfaction and loyalty, particularly in highly competitive banking environments (Sulaiman et al., 2021). More recent digital-banking research further demonstrates that reliable, secure, and user-friendly electronic

service quality strengthens satisfaction, trust, and ultimately customer loyalty (Zhang, 2025; Future Business Journal, 2026).

While these studies provide valuable insights, most have examined these constructs in isolation focusing separately on e-service quality, electronic banking adoption, or cybersecurity systems (Hammoud et al., 2018; Sulaiman et al., 2021). Such fragmented approaches do not adequately reflect the integrated nature of modern banking ecosystems, where cloud infrastructure, cybersecurity mechanisms, and digital service delivery interact simultaneously to shape customer experiences, satisfaction, and loyalty (Aripin, 2025; Heliyon, 2024).

More importantly, prior research in the Nigerian context has primarily emphasized direct relationships between service quality factors and customer satisfaction or loyalty, without explicitly modeling the mediating role of customer satisfaction within cloud-enabled banking environments. This represents a significant conceptual and empirical gap. As banks increasingly migrate critical operations to cloud infrastructures, customer perceptions are no longer shaped solely by traditional service attributes; instead, they are influenced by the combined effects of cloud service performance, data security, and digital service quality. Yet, few studies have examined these variables simultaneously within a unified structural model (Kanchepu, 2023; Kumar et al., 2023).

Therefore, the central problem addressed in this study is the lack of empirical evidence on how cloud service quality, security, and service quality dimensions jointly influence customer loyalty through the mediating role of customer satisfaction in the Nigerian banking sector. Specifically, previous studies have not examined the simultaneous influence of cloud services, security, and service quality within a Nigerian banking context using a structural equation modeling (SEM) approach.

To address this gap, this study investigates the integrated effects of cloud services, security, and service quality on customer loyalty, with customer satisfaction serving as a mediating variable. By adopting a comprehensive analytical framework, the study provides deeper insights into how technological and service-related factors collectively shape customer behavior in cloud-enabled banking environments. The findings are expected to contribute to digital banking literature and offer practical guidance for Nigerian banks seeking to enhance customer satisfaction and loyalty in an increasingly competitive and technology-driven financial landscape.

Underpinning Theory

To establish a robust analytical foundation, this study synthesizes three complementary theoretical paradigms: the Technology Acceptance Model (TAM) (Davis, 1989), the SERVQUAL model (Parasuraman et al., 1988), and Expectation-Confirmation Theory (ECT) (Oliver, 1980). Rather than analyzing technology infrastructure and service delivery in isolation, this multi-theoretical framework connects technological capability, operational execution, and post-consumption psychological processing to explain consumer retention in cloud-driven banking ecosystems. Together, these theories provide an explanatory bridge linking system-level technological inputs with higher-order cognitive evaluations and long-term behavioral outcomes.

Within this integrated architecture, TAM provides the theoretical foundation for Cloud Services (CLS), positing that system adoption and continuous usage depend on perceived usefulness and perceived ease of use. In modern digital banking, high-performing cloud infrastructure enhances platform accessibility, transaction speed, and dynamic uptime, thereby lowering perceived user effort while optimizing functional utility. Simultaneously, the SERVQUAL framework grounds both Service Quality (SQ) and Security of Banking Services (SBS). While Service Quality reflects operational responsiveness, platform reliability, and seamless navigation across digital touchpoints, Security of Banking Services operationalizes the assurance

dimension by instilling institutional trust, safeguarding financial data, and mitigating

perceived security risks through advanced encryption protocols.

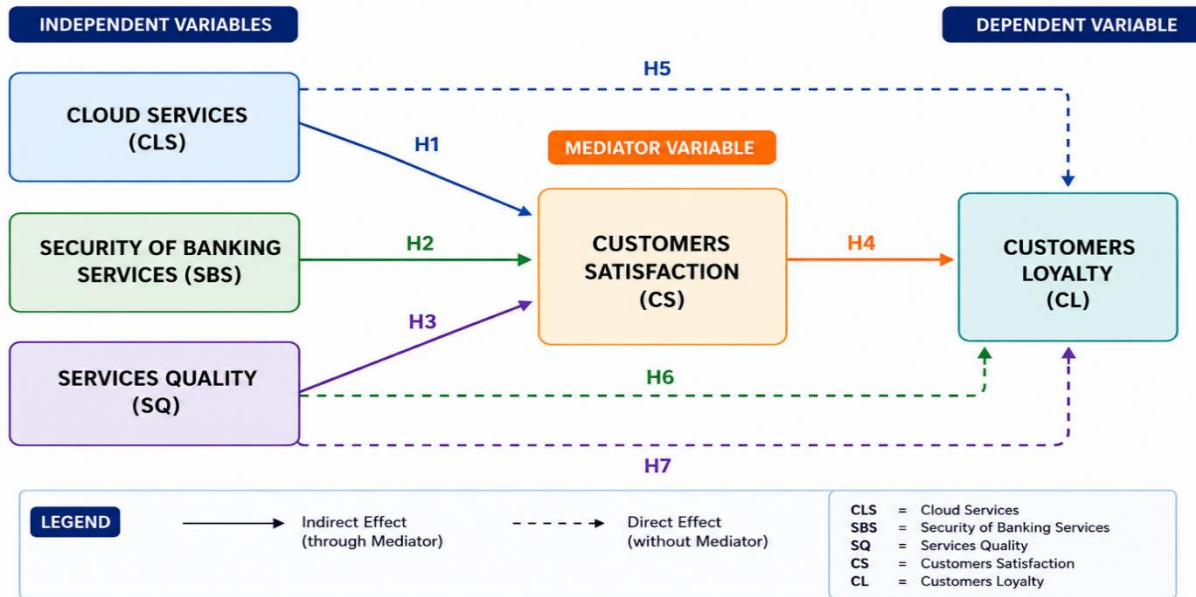


Figure 1 Theoretical Framework

Finally, Expectation-Confirmation Theory (ECT) provides the psychological mechanism explaining how these exogenous technological and operational attributes translate into Customer Satisfaction (CS) and subsequent Customer Loyalty (CL). According to ECT, post-adoption satisfaction arises when perceived service performance confirms or exceeds initial customer expectations. When a bank's cloud architecture, security measures, and service delivery successfully confirm consumer expectations, positive cognitive and affective evaluations occur, yielding elevated customer satisfaction. In turn, this satisfied state acts as a critical mediating mechanism that drives enduring customer loyalty, manifested through account maintenance, continuous service usage, and positive brand advocacy.

Relationship Between the Variables and Hypothesis Development

Customers Satisfaction with Banking Services and Customers Loyalty

Customer satisfaction is widely recognized as a key factor influencing customer loyalty (Coetzee et al., 2013; Hussain et al., 2015; Izogo & Ogb,

2015; Kim et al., 2011; Makanyeza, & Chikazhe, 2017). A study conducted in the Greek banking industry concluded that customers satisfaction positively influences loyalty (Lewis & Soureli, 2006). Correspondingly, customers satisfaction have positive direct effects on loyalty in the Zambian banking sector (Makanyeza, & Chikazhe, 2017). Ganguli and Roy (2011) found similar results among undergraduate students in Massachusetts using technology-based banking services.

Numerous studies have established a positive relationship between customer satisfaction and customer loyalty across various industries and regions. Delgado-Bellester and Manuera-Aleman (2001) found that customer satisfaction significantly influences loyalty. Similarly, Fullerton and Taylor (2002) provided further insight by identifying a non-linear relationship, where higher satisfaction levels led to a stronger impact on loyalty intentions. Yang and Peterson (2004) reinforced this by confirming that customer satisfaction is a strong predictor of loyalty. Deng et al. (2010) and Santouridis & Trivellas (2010) confirmed that satisfaction positively affects customer loyalty in China's and Greece's mobile telephony sectors, respectively.

Therefore, the following hypothesis is proposed that:

H1: Customer satisfaction with banking services has a significant positive impact on customer loyalty.

Cloud Services and Customers Satisfaction with Banking Services

The integration of cloud services into banking operations has become a pivotal strategy for enhancing customer satisfaction. Cloud services offers banks the flexibility and scalability needed to provide efficient and reliable services, which are crucial for meeting customer expectations in the digital age. A study by Li et al. (2021) identified four key factors that significantly influence customer satisfaction in e-banking: cloud services, security, e-learning, and service quality. Asadi, Nilashi, and Husin (2017) explores customer perspectives on the adoption of cloud computing in the banking sector. The key findings suggest that cloud-based applications in banking positively influence customers' trust and satisfaction. Several studies highlight a strong relationship between customer satisfaction and E-Banking services. Asiyanbi and Ishola (2018) found that customer satisfaction in the banking sector improves with the use of E-Banking services. Similarly, Ranaweera and Neely (2003) emphasized that high-quality E-services are the foundation of customer satisfaction.

In a study conducted by Agarwal, R., & Dhingra, S. (2023). explore the determinants of cloud service quality and how they affect customer satisfaction and loyalty. The research involved a survey of 419 cloud experts and users in India, focusing on those utilizing services from the top five cloud providers in the country. The result suggested a positive and substantial link between cloud service and customer satisfaction and customer satisfaction mediates the link between cloud service quality and customer loyalty. Meaning that Cloud Service quality has a direct as well as indirect impact on customer loyalty via customer satisfaction. Hence hypothesis H2a and H2b are proposed.

H2a: Cloud services have a significant positive impact on customers satisfaction

H2b: Customer satisfaction mediates the link amid Customers satisfaction with banking services and customer loyalty.

Security of Banking Services and Customers Satisfaction with Banking Services

The relationship between security and customer satisfaction has been extensively studied, with varying conclusions across different contexts. A study examining the Indian banking sector found that perceived security positively influences customer satisfaction. When customers feel their transactions are secure, their trust in the banking system increases, leading to higher satisfaction levels (Abdul Sathar et al., 2023). Similarly, research focusing on Nigerian banks revealed that perceived security significantly impacts e-banking adoption and customers satisfaction. Lack of concerns over security can deter customers from using electronic banking services, thereby affecting their overall satisfaction (Salimon, 2013). In the context of electronic banking, studies have shown that security protocols, significantly influence customer satisfaction ((Belás et al., 2016; Li et al., 2021).

Furthermore, a study conducted in Zambia banking sector indicated that security is a critical factor influencing customer satisfaction in online banking, as customers are more likely to be satisfied when they perceive the platform as secure (Mwiya et al., 2022). In the Lebanese banking sector, research demonstrated that security and privacy are significant predictors of customer satisfaction. It is concluded that customers who perceive their banking transactions as secure are more likely to be satisfied with the service (Hammoud et al., 2018). Conversely, a study investigating the influence of security statements and technical protection on satisfaction and loyalty found that while security statements positively influenced customers satisfaction, technical protection did not have a significant effect on loyalty (Chang & Chen, 2010). This suggests that the mere presence of technical security measures may not directly enhance satisfaction and customer loyalty. Furthermore, research focusing on Software-as-a-

Service (SaaS) providers indicated that security perceptions significantly affect client satisfaction when mediated by perceived value. In an unmediated model, security did not show a significant direct effect on customers satisfaction, implying that the perceived value of security measures plays a crucial role in determining their impact on customer satisfaction (Benlian et al., 2015). These findings suggest that while security measures are essential, their direct impact on customer satisfaction may not always be significant. Factors such as perceived value, trust, and the effectiveness of security communication to customers can mediate this relationship. Therefore, businesses should not only implement robust security measures but also ensure that these measures are effectively communicated and add perceived value to the customer experience. Hence Hypothesis 3a and 3b are proposed as follows:

H2a: Security of Banking Services have a significant positive impact on customers satisfaction.

H2b: Customer satisfaction mediates the link amid Security of banking services and customer loyalty.

Service Quality and Customers Satisfaction in the banking system

Service quality is a pivotal factor influencing customer satisfaction in the banking sector. Research indicates that service quality significantly influences customer satisfaction, which in turn fosters customer loyalty (Famiyeh et al., 2018). Similarly, service quality dimensions such as reliability, assurance, tangibles, empathy, and responsiveness significantly impact customer perceptions (Ayinaddis et al., 2023; Sureshchandar et al., 2002). Bei and Chiao (2006) also identified a significant link between service quality and customer satisfaction in the banking sector.

Research across various industries has consistently shown that customer satisfaction plays a mediating role in the relationship between service quality and customer loyalty. In the banking sector, service quality positively influences customer satisfaction, which in turn enhances loyalty, as evidenced by a study in

Zimbabwe where both customer satisfaction and corporate image mediated this relationship (Makanyeza & Chikazhe, 2017). Research in the Jordanian commercial banking sector revealed that while service quality positively affects customer loyalty, this relationship is significantly mediated by customer satisfaction. This suggests that enhancing service quality boosts customer satisfaction, which subsequently fosters loyalty (Al-Slehat, 2021). Similarly, in the fast-food industry, efficient service quality has been found to improve customer satisfaction, leading to greater customer loyalty (Liu et al., 2017). In the telecommunications sector, research in Ghana revealed that customer satisfaction partially mediates the effect of service quality on customer loyalty, highlighting its crucial role in customer retention (Nyan et al., 2020). These findings suggest that organizations across different industries should focus on improving service quality to enhance customer satisfaction, which ultimately fosters customer loyalty.

Therefore, H4a and H4b are proposed as follows:

H4a: Services quality have a significant positive impact on customers satisfaction.

H4b: Customer satisfaction mediates the link amid services quality and customer loyalty.

Conceptual Framework

The proposed theoretical framework examines customer loyalty in the banking sector, using customer satisfaction as a mediating variable while considering cloud services, security, and service quality as independent variables. The research aims to analyze both **direct** and **indirect** relationships, where customer satisfaction serves as a bridge between the independent variables and customer loyalty. The conceptual framework provides a comprehensive approach to studying customer loyalty in banking industry. By considering customer satisfaction as a mediator, the research can reveal deeper insights into how cloud services, security, and service quality shape customer experiences and loyalty.

Research Methodology

Instrument development

The constructs used in this study were adopted from previous literature and subsequently adapted into fit the context of this study. Each item was measured using a seven-point Likert-type scales anchored at (1) “Strongly disagree” to (7) “Strongly agree”. Cloud services and Security of banking services were measured with five items adapted from Li, et. al., (2021). Customers loyal, Customers satisfaction with banking services, and services quality were measured using six, five and six item scales, respectively, adapted from Makanyeza, and Chikazhe, (2017).

Data collection Procedure

Internet banking users from three commercial banks, within Kaduna metropolis were, chosen as the primary participants for the study. Four hundred and fifty questionnaires were distributed to Internet banking users in May 2024. Participation in the survey was voluntary. Thus, A total of three hundred and twenty-one responses were received, but thirty of these were excluded based on two criteria: (1) incomplete questionnaires and (2) responses that indicated a lack of seriousness. as suggested by Samar et al. (2017). At the end, 291 questionnaires were

utilized for statistical analysis, resulting in a response rate of 91%.

Data analysis and results

Data analysis was conducted using structural equation modeling (SEM), consistent with prior research (Bilro et al., 2018). SEM is considered the most suitable method for studies in management and marketing (Ali et al., 2018; Jamshidi et al., 2018; Rousta and Jamshidi, 2020). As noted by Hair et al. (2014), "structural equation modeling (SEM) is a statistical technique for testing and estimating causal relationships using a combination of statistical data." Following the two-step approach recommended by Anderson and Gerbing (1988), the research model was evaluated through both the measurement model and the structural model. The measurement model examined the reliability and validity of the instrument, while the structural model was analyzed the coefficient of determination (R^2), beta values, and the associated t-values (Rahi, 2017). The SmartPLS-3.2.7 software was employed to estimate the causal relationships among the proposed hypotheses.

Assessment of the Measurement model

To assess the measurement model, this study adhered strictly to the guidelines set by Hair et al. (2014), where construct, convergent, and discriminant validity were assessed. refers to the

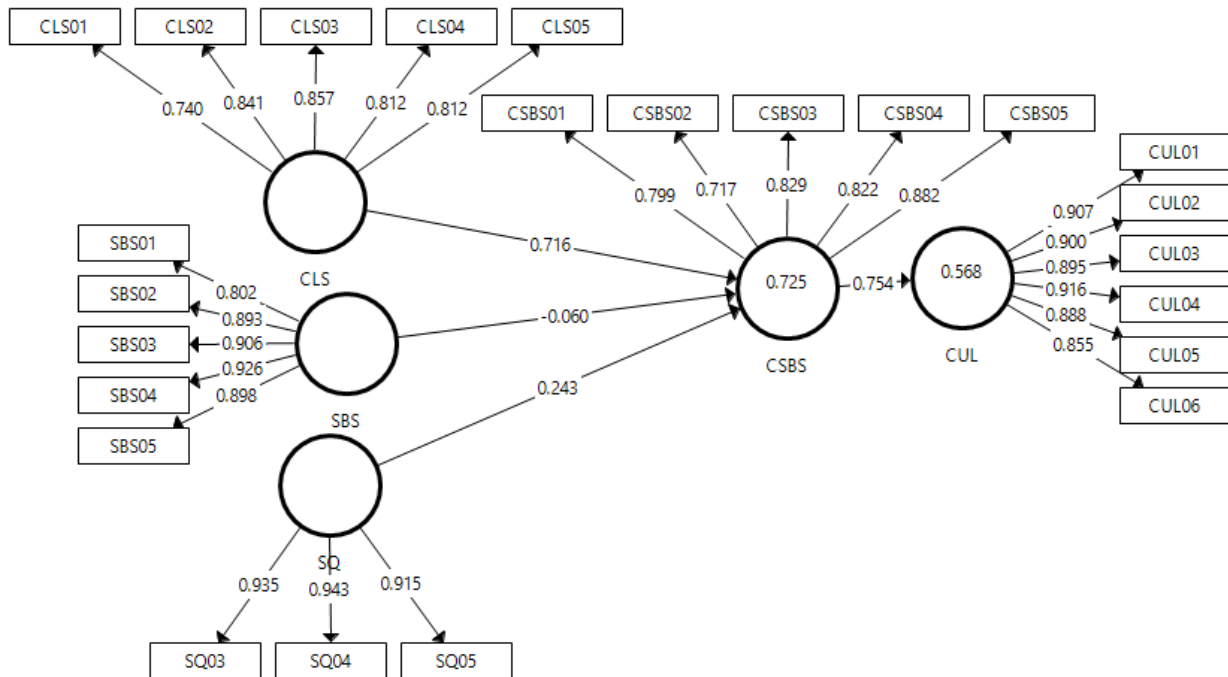


Figure 1.
Measurement Model

Construct validity

Construct validity refers to the extent to which outcomes derived from relevant theories accurately measure the test being evaluated (Sekaran & Bougie, 2016). Content validity of the measurement model (MM) can be established by focusing on factors such as item loadings (Hair et al., 2013). Specifically, items should have higher loadings on their intended construct compared to other constructs (Chin, 2010). If any items load more significantly on other constructs than their own, they will be excluded (Hair et al., 2013). This study adopts a benchmark of 0.7 (Hair, Hult, Ringle, & Sarstedt, 2014). As shown in Table 1 below, all items exhibited higher loadings on their hypothesized factors than on other factors, thereby confirming the content validity of the measurement model.

To assess the reliability of the measurements, we report Cronbach's α and composite reliability for each exogenous variable. While Cronbach's α is more commonly used, it tends to underestimate internal consistency reliability. Composite reliability is a more precise measure of internal

consistency reliability (Hair et al., 2016) with less restrictive assumptions. Its value is interpreted in a similar way to Cronbach's α . Inspecting the values in Table I, both measures far exceed the commonly cited minimum threshold of 0.7 for each construct, confirming internal consistency reliability. The composite reliability (CR) is calculated as follows:

$$P_c = \frac{(\sum_{i=1}^M l_i)^2}{(\sum_{i=1}^M l_i)^2 + \sum_{i=1}^M (e_i)}$$

The Cronbach reliability scores were calculated for each of the remaining factors and items to further purify the dimensions. The Cronbach's alpha can be calculated using a given formula as:

$$\alpha = \frac{K}{K-1} \left(1 - \frac{\sum S_i^2}{S_t^2} \right)$$

where k is the number of items, S_i^2 is the variance of the i th item and S_t^2 is the variance of the total score formed by summing all the items. If the items are not simply added to make the score, but first multiplied by weighting coefficients, we multiply the item by its coefficient before calculating the variance S_i^2 . Clearly, we must

have at least two items—that is $k > 1$, or α will be undefined.

On the other hand, the construct validity is measured by assessing the average variance extracted (AVE) of each latent construct as recommended by Fornell & Larcker (1981). The AVE value is calculated as the mean of the squared loadings for all indicators associated with a construct as follows:

$$AVE_{ej} = \frac{\sum_{k=1}^{kj} \lambda_{jk}^2}{\sum_{k=1}^{kj} \lambda_{jk}^2 + \theta_{jk}}$$

Table 1. Convergent validity

Construct	Items	Factor Loadings	Cronbach's Alpha	Composite reliability	Average variance extracted (AVE)
Cloud Services (CLS)	CLS01	0.740	0.873	0.907	0.661
	CLS02	0.841			
	CLS03	0.857			
	CLS04	0.812			
	CLS05	0.812			
Customers Satisfaction with Banking Services (CSBS)	CSBS01	0.799	0.870	0.906	0.658
	CSBS02	0.717			
	CSBS03	0.829			
	CSBS04	0.822			
	CSBS05	0.882			
Customers Loyalty (CUL)	CUL01	0.907	0.931	0.948	0.785
	CUL02	0.900			
	CUL03	0.895			
	CUL04	0.916			
	CUL05	0.888			
	CUL06	0.855			
Security of Banking Service (SBS)	SBS01	0.802	0.931	0.948	0.785
	SBS02	0.893			
	SBS03	0.906			
	SBS04	0.926			
	SBS05	0.898			
Service Quality (SQ)	SQ03	0.935	0.923	0.951	0.867
	SQ04	0.943			
	SQ05	0.915			

Where

AVE_{ej} = Average Variance Extracted

λ_{jk}^2 = Sum of standardized loadings square

θ_{jk} = Error variance of the k^{th} indicator ($k = 1, \dots, K_j$)

Thus, all the indicators were retained because the average variance extracted (AVE) for the latent variables were higher than 0.50. Table 1 presents the measurement model results.

Discriminant Validity

To further examine the discriminant validity, we used Fornell and Larcker's criterion (Fornell and Larcker, 1981). Discriminant validity indicates the extent to which “items differentiate among constructs and measure distinct concepts” (Fornell and Larcker, 1981). Adequate discriminant validity is that the square root of AVE should be larger than its correlation

coefficients with other pair of constructs (Fornell and Larcker, 1981). As shown in Table 2, the square root of AVE is greater than off-diagonal factors in the corresponding rows and column, indicating discriminant validity. These findings confirmed that measurement model has good indicator reliability, internal consistency, convergent validity and discriminant validity and can be used for structural model.

Table 2 Fornell-Larcker Criterion

Latent Variables	CLS	CSBS	CUL	SBS	SQ
Cloud Services	0.813				
Customers Satisfaction with Banking Services	0.834	0.811			
Customers Loyalty	0.729	0.754	0.894		
Security of Banking Services	0.824	0.691	0.715	0.886	
Service Quality	0.688	0.696	0.967	0.663	0.931

The discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio of correlations, as shown in Table 3. The HTMT ratio represents the average of correlations be

tween different traits measured by different methods (heterotrait-heteromethod) in relation to the average of correlations for the same trait measured by different methods (monotrait-heteromethod). Monotrait-heteromethod correlations are derived from indicators that assess the same constructs, while heterotrait-heteromethod correlations are obtained from indicators that evaluate different constructs. The formula for calculating HTMT is provided as follows:

$$HTMT_{IJ} = \frac{1}{K_i K_j} \sum_{g=1}^{K_i} \sum_{h=1}^{K_j} r_{ig,hj} \div \left(\frac{2}{K_i(K_i-1)} \cdot \sum_{g=1}^{K_i-1} \sum_{h=g+1}^{K_i} r_{ig,ih} \cdot \frac{2}{K_j(K_j-1)} \cdot \sum_{g=1}^{K_j-1} \sum_{h=g+1}^{K_j} r_{jh,jh} \right)^{\frac{1}{2}}$$

Thus, HTMT values fell within the confidence intervals for both the lower and upper bounds, confirming the presence of discriminant validity.

Table 3 Heterotrait-Monotrait Ratio (HTMT)

Latent Variables	CLS	CSBS	CUL	SBS	SQ
Cloud Services					
Customers Satisfaction with Banking Services	0.925				
Customers Loyalty	0.801	0.804			
Security of Banking Services	0.923	0.754	0.758		
Service Quality	0.768	0.754	1.036	0.715	

Assessment of the Structural Model

The theoretical model was additionally evaluated to determine the proposed causal relationships, which included estimating the path coefficients, the coefficient of determination (R^2), significance levels derived from the corresponding t-values, and Stone-Geisser's Q^2 , in accordance with the guidelines provided by Hair et al. (2016).

Hypothesis testing.

To evaluate the structural model and test the proposed hypotheses, a nonparametric bootstrapping procedure with 5,000 resamples was executed at a 95% bias-corrected confidence interval in accordance with Partial Least Squares Structural Equation Modelling (PLS-SEM)

guidelines (Hair et al., 2016, 2017). The analytical framework evaluated the coefficient of determination (R^2), the magnitude and statistical significance of the direct path coefficients (β), and the indirect mediating mechanisms. Establishing explanatory power prior to path evaluation, (R^2) values of 0.75, 0.50, and 0.25 in empirical management research are benchmarked as substantial, moderate, and weak, respectively (Hair et al., 2017). In this study, the PLS path analysis yielded an R^2 value of 0.568 for the primary dependent construct, Customer Loyalty (CL), indicating that Customer Satisfaction (CS), Cloud Services (CLS), Security of Banking Services (SBS), and Service Quality (SQ) collectively account for 56.8% of the total variance in customer loyalty, demonstrating moderate-to-substantial predictive strength within the digital banking context.

The significance of the path coefficients was evaluated using a bootstrapping method. The findings indicated that Customers Satisfaction with Banking Services has a positive effect on customers loyalty ($\beta = 0.754$, $\rho < 0.001$), thereby supporting Hypothesis 1 (H1). Additionally, Cloud Services was found to positively influence Customers Satisfaction with Banking Services thereby supporting hypothesis (H2a). Likewise, Customers Satisfaction with Banking Services was found to mediate the relationship between cloud services and customers loyalty ($\beta = 0.25$, $\rho < 0.001$). Hence supporting Hypothesis (H2b). Hypothesis 3 (H3a and H3b) was not supported, as security of banking services has no significant impact on Customers Satisfaction with Banking Services and its mediating role ($\beta = 0.063$, $\rho > 0.05$; $\beta = 0.047$, $\rho > 0.05$).

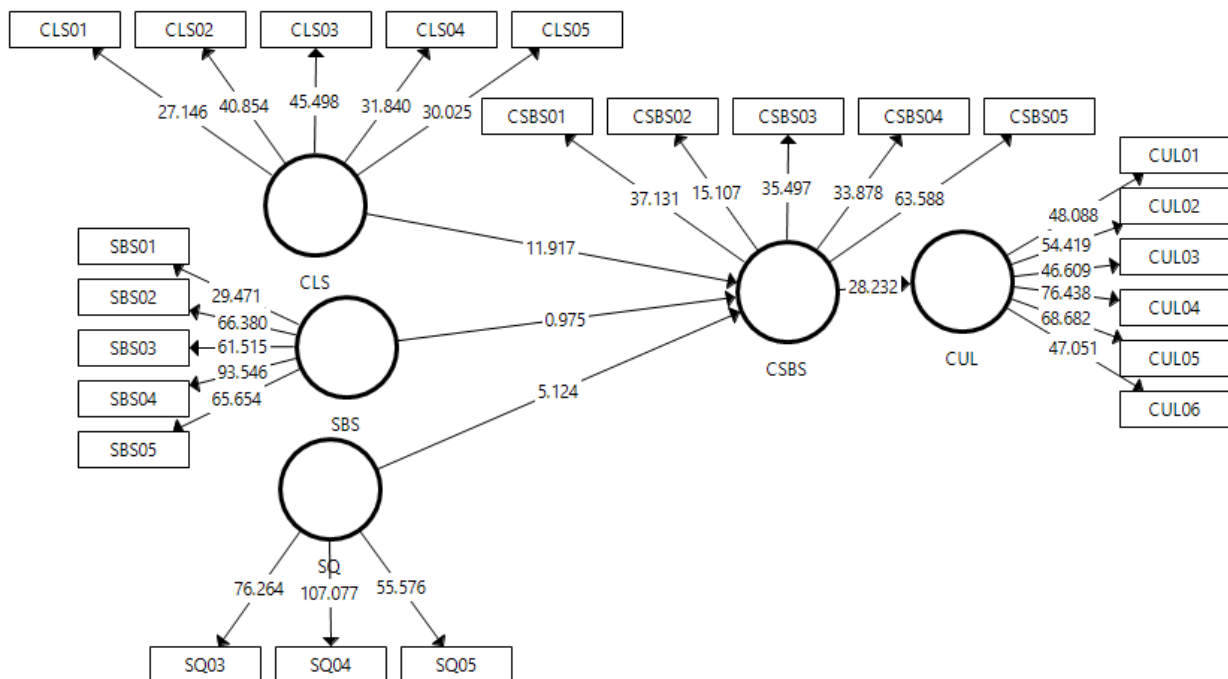


Figure 2.

Structural Model

Furthermore, Hypotheses 4 H4a and H4b) were supported, indicating that service quality has a significant positive impact on Customers Satisfaction with Banking Services ($\beta = 5.124$, $p < 0.05$). and Customers Satisfaction with Banking Services mediate the relationship between service quality and customers loyalty ($\beta = 4.671$, $p < 0.05$)

Table 4. Path Coefficients

Hypothesis	Relationship	B	SD Error	T Statistics	P Values	Findings
H1	CSBS→CUL	0.754	0.027	28.23	0.000***	Supported
H2a	CLS→CSBS	0.720	0.060	11.92	0.000***	Supported
H2b	CLS→CSBS→CUL	0.542	0.041	13.237	0.000***	Supported
H3a	SBS → CSBS	0.063	0.062	0.98	0.330	Not Supported
H3b	SBS →CSBS→CUL	0.047	0.046	0.984	0.325	Not Supported
H4a	SQ →CSBS	0.243	0.047	5.124	0.000***	Supported
H4b	SQ →CSBS→CUL	0.184	0.039	4.671	0.000***	Supported

Note: ***Significant at 1%,
 **Significant at 5%,
 *Significant at 10%

Evaluation of Effect Size (f^2)

The Effect size (f^2) is used in evaluating the relative impact of one construct (variables) in terms of its predictive relevance. The effect size for each path model can be determined by calculating Cohen's f^2 . The effect size of the constructs was tested using effect size analysis. Cohen (1988) suggested the following values as listed below:

$$\text{Effect Size } (f^2) = \frac{R^2_{\text{Included}} - R^2_{\text{Excluded}}}{1 - R^2_{\text{Included}}}$$

$0.02 \leq f^2 < 0.15$ = Weak effect

$0.15 \leq f^2 < 0.35$ = Moderate effect

$f^2 \geq 0.35$ = Strong effect

The empirical findings presented in Table 5 reveal substantial variation in the predictive

Table 5: Effect Sizes Using Cohen's (1988)

	Latent Variables	R ² Included	R ² Excluded	F2	Effect Size
1	Cloud banking Services	0.568	0.958	0.90	Strong Effect
2	Customers Satisfaction with Banking Services	0.568	0.593	0.06	Weak Effect
3	Security of Banking Services	0.568	0.569	0.002	Weak Effect
4	Service Quality	0.568	0.559	0.020	Weak Effect

significance among the latent constructs. Cloud Banking Services demonstrated a dominant and statistically profound effect size ($f^2 = 0.900$), substantially exceeding the 0.350 criterion for a large effect. This demonstrates that cloud infrastructure capabilities represent the core explanatory anchor within the structural framework, where omitting this variable severely compromises the model's predictive capacity. Conversely, Customer Satisfaction with Banking Services ($f^2 = 0.060$) and Service Quality ($f^2 = 0.020$) exhibited small effect sizes, indicating that while their contributions remain relevant, their incremental power in explaining variance is secondary. Lastly, Security of Banking Services yielded an f^2 value of 0.002, signifying a negligible direct effect size within the specified structural model.

Evaluation of Predictive Relevance

The model was checked with Stone-Geisser's Q2. We assessed predictive relevance Q2 using the blindfolding procedure, as suggested by Hair et al. (2016b). In order to achieve acceptable predictive relevance of the model, it is recommended that values should be greater than 0 indicating that outlined model has predictive relevance for a certain endogenous construct (Cohen, 1988; Hair et al., 2016b). Additionally, predictive relevance values Q2 of 0.35, 0.15 and 0.02 are considered as large, medium and small predictive relevance of the model.

Predictive relevance Q2 can be assessed using Cross-validated redundancy (Q²) as shown in the formula:

$$Q_J^2 = 1 - \frac{\sum_G SSE_{JG}}{\sum_G SSO_{JG}}$$

Where: Q_J² = Cross-validated redundancy

∑_G SSE_{JG} = Sum of squares of prediction errors for Block J

∑_G SSO_{JG} = Sum of squares of original data observations for Block J

Table 6. presents the cross-validated redundancy of the research models

Table 6: Constructs Cross-Validated Redundancy of the Research Models

Latent Variables	SSO	SSE	Q ² (=1-SSE/SSO)
Cloud Services	1455.000	1455.000	
Customers Satisfaction with Banking Services	1455.000	781.075	0.463
Customers Loyalty	1746.000	967.801	0.446
Security of Banking Services	1455.000	1455.000	
Service Quality	873.000	873.000	

As can be observed from Table 6. the blindfolding analysis yielded Q² values substantially higher than zero for both endogenous constructs in the model. Specifically, Customer Satisfaction with Banking Services achieved a Q2 value of 0.463 while Customer Loyalty achieved a Q² value of 0.446. These findings demonstrate that the conceptual framework possesses a medium to large (strong) predictive relevance for both key outcome constructs. Overall, the results confirm that the structural model reliably predicts customer satisfaction and customer loyalty in the digital banking context (Chin, 1998; Henseler et al., 2009).

Assessment of the overall Model Fit

Recently, a standardized measurement for evaluating overall model fit in Partial Least Squares (PLS) analysis has been introduced, with values ranging from 0 to 1. According to Sureshchandar et al. (2002), three specific thresholds have been established: 0.01, 0.25, and

0.36, which represent weak, moderate, and strong goodness-of-fit (GOF) levels, respectively. A GOF value near 0.01 suggests a weak model fit, indicating the need for adjustments in the relationships among the model constructs. In contrast, a GOF of 0.25 indicates a moderate fit, while a value of 0.36 signifies a strong fit (Sureshchandar et al., 2002). For instance:

$$GOF = \sqrt{AVE \times R^2} \dots \dots \dots \text{Equation 1}$$

$$\mu AVE =$$

$$\frac{1}{n} \sum_{i=1}^n xi \dots \dots \dots \text{Equation 2}$$

$$\mu AVE = \frac{0.661 + 0.658 + 0.785 + 0.785 + 0.867}{5}$$

$$\mu AVE = \frac{3.756}{5}$$

$$\mu AVE = 0.7512$$

Also, in order to attain the standard model's overall fit, we must obtain the mean R²:

$$\mu R^2$$

$$= \frac{1}{n} \sum_{i=1}^n xi \dots \dots \dots \text{Equation 3}$$

$$\mu R^2 = 0.568$$

By Substituting equation (2) and equation (3) into Equation (1), the value of GOF is obtained as follows:

$$GOF = \sqrt{AVE \times R^2}$$

$$GOF = \sqrt{0.7512 \times 0.568}$$

$$GOF = \sqrt{0.43}$$

$$GOF = 0.653$$

Thus, the result obtain indicates that the research model has strong model fit.

Importance performance matrix analysis (IPMA)

The Importance-Performance Matrix Analysis (IPMA) is a valuable tool for identifying key areas within a research model that can enhance managerial practices (Rahi and Ghani, 2019). IPMA compares the total effects of the structural model (importance) with the average scores of latent variables (performance) for specific endogenous constructs (Hair et al., 2016). In this

context, importance scores are obtained from the total effects of the outcome variable in the structural equation model, while performance scores are calculated by rescaling the range of latent variable scores from 0 (lowest) to 100 (highest) (Rahi et al., 2018).

Table 7. IPMA Total Effects and Index Values

Latent Variables	Importance (total effect of the latent variable Customers Loyalty)	Performance (index values)
Cloud Services	0.540	66.719
Customers Satisfaction with Banking Services	0.754	69.452
Security of Banking Services	-0.045	67.240
Service Quality	0.183	73.971

Table 7 indicates results of IPMA using Customers loyalty as target construct. The findings presented in Table 5 indicate that Customers Satisfaction with Banking Services is the most significant factor, followed closely by cloud services, which is the second most important factor for managerial focus. Other

factors, including security of banking services with lowest importance and services quality, hold a moderate level of importance in predicting customers loyalty. Notably, while the latent construct of service quality demonstrated the highest performance, it is not deemed a critical factor for managerial implications.

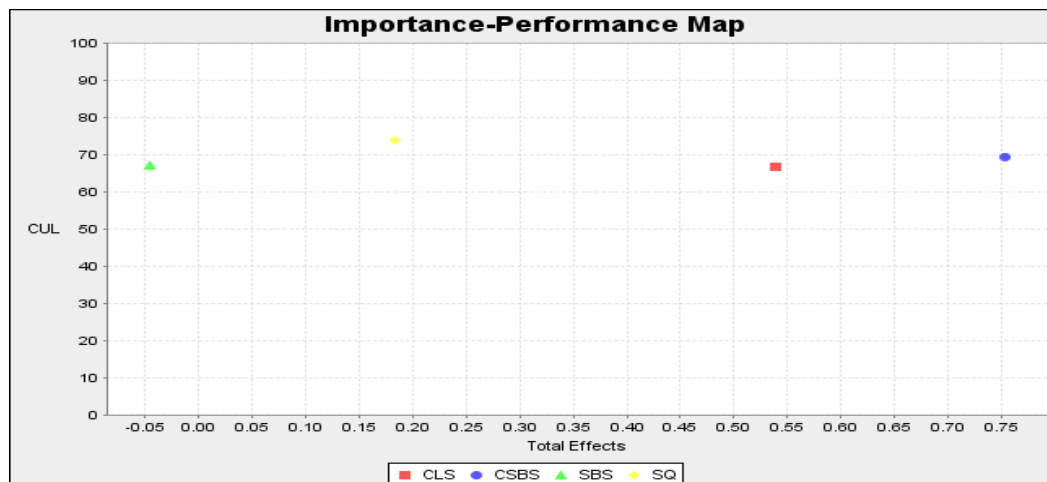


Figure 4.
IPMA priority map with outcome variable customer Loyalty

We also plotted importance and performance scores in IPMA priority map as shown in Figure 3. It can be observed that Service Quality and Customers Satisfaction with Banking Services, are the most important factors. IPMA map further shows that cloud services and security of banking services have an intermediate level of importance.

Discussion

The primary aim of this research was to identify the essential factors influencing customers loyalty in Nigeria, as well as to examine the effects of cloud services, security of banking services and service quality on customer satisfaction and loyalty. Additionally, the study explored the role of customer satisfaction as a mediating variable in the relationship between cloud service, security, services quality and customer loyalty. A comprehensive literature review was conducted to gather insights on the factors affecting customer satisfaction, and loyalty.

The proposed model validates the relationships between the objectives of the study. The findings indicated that Customers Satisfaction with Banking Services has a significant positive impact on customers loyalty which is inline with the previous studies (Makanyeza, & Chikazhe, 2017; Lewis & Soureli, 2006; Ganguli & Roy, 2011). Therefore, it will be concluded that when

customers perceive their satisfaction with banking services to be high, they are more likely to remain loyal to the bank.

Cloud services have direct and indirect positive impact on customer satisfaction with banking services and loyalty. The result corroborates the findings of other scholars (Li et al. (2021; Nilashi, & Husin, 2017; Asiyambi, & Ishola, 2018; Agarwal, & Dhingra, 2023). Cloud services enable banks to provide seamless digital services, improve data management, and enhance customer experience. Banks can leverage on cloud computing as a foundation for developing their own services (Li et al., 2021). It is important to note that customer satisfaction is crucial in the banking sector as it mediates the relationship between cloud services and customer loyalty. When banks effectively utilize cloud services, they can enhance customer satisfaction, which in turn fosters greater loyalty among customers (Khawaja et al., 2021). The implementation of cloud services leads to improved service delivery (Sarfranz et al., 2022).

Additionally, the findings of this study indicate that security of banking services has no significant impact on direct and indirect relationship with Customers Satisfaction with Banking Services. The findings of this study was in support of the previous studies (Chang & Chen, 2010; Benlian et al., 2015; Benlian et al., 2015). This indicates that as banking services continue

to evolve with technology, customer expectations regarding security also change. A lack of robust security measures can lead to dissatisfaction, especially as customers become more aware of potential risks associated with online banking (Liébana-Cabanillas et al., 2013). Therefore, the failure to recognize the importance of security in customer satisfaction could lead to misguided strategies in service delivery.

Lastly, the study revealed that services quality has both direct and mediate effect with customer satisfaction and loyalty. This finding reinforces the notion that customer satisfaction plays a mediating role in the relationship between service quality and customer loyalty, as supported by previous research (Agarwal, & Dhingra, 2023; Makanyeza, & Chikazhe, 2017). When service quality meets or exceeds customer expectations, it leads to higher satisfaction. Therefore, customers who perceive high service quality are more likely to report higher satisfaction levels, which is essential for fostering loyalty. This relationship suggests that improving service quality can lead to increased customer satisfaction, which in turn enhances customers loyalty.

Theoretical and managerial implications

This study offers valuable theoretical insights by examining the relationships between customer satisfaction with banking services, cloud services, the security of banking services, and service quality in Nigerian commercial banks—an area that has been previously underexplored. By addressing this theoretical gap, the study responds to calls for more complex research in Africa's burgeoning banking industry.

The findings indicate that all variables, except for the security of banking services, significantly influence customer loyalty. As competition intensifies in the Nigerian banking sector, understanding these factors is crucial for banks seeking to enhance customer loyalty and profitability. Notably, cloud banking services and service quality emerge as key drivers of customer loyalty, impacting it both directly and indirectly, which in turn contributes to customer satisfaction.

High-quality service leads to increased patronage. Therefore, to foster loyalty among customers, banks must prioritize delivering exceptional service that enhances customer satisfaction. Managers should ensure that staff are knowledgeable, responsive, courteous, and uphold strong ethical values in their interactions with customers.

Conclusion

This study empirically investigated the structural relationships between Cloud Services, Security of Banking Services, Service Quality, Customer Satisfaction, and Customer Loyalty within the contemporary banking sector. Utilizing Partial Least Squares Structural Equation Modelling (PLS-SEM), the empirical findings confirm that cloud infrastructure, security measures, and service quality, operating alongside customer satisfaction, account for 56.8% of the total variance in customer loyalty, while exhibiting strong out-of-sample predictive relevance. A central insight from this research is the dominant predictive role of Cloud Services, which serves as the primary technological driver of customer loyalty, whereas traditional security protocols and general service quality function predominantly as baseline operational requirements. Furthermore, the results validate Customer Satisfaction as a pivotal mediating mechanism, establishing that investments in advanced cloud architecture do not automatically yield brand loyalty unless they directly translate into a seamless, reliable, and satisfying user experience. Consequently, financial institutions must strategically prioritize cloud performance and user-centred digital service optimization to foster enduring customer satisfaction in an increasingly competitive digital financial ecosystem.

Limitations and Directions for Future Research

To address the inherent limitations of this study, future research should adopt longitudinal, or time-series designs to capture how customer loyalty behaviors evolve alongside continuous advancements in cloud infrastructure and financial technology. Additionally, scholars are encouraged to extend the structural framework by

incorporating emerging digital constructs such as Artificial Intelligence (AI)-driven hyper-personalization, Open Banking APIs, and omnichannel service quality to account for the remaining 43.2% unexplained variance in customer loyalty. Future studies should also utilize Partial Least Squares Multigroup Analysis (PLS-MGA) to examine potential boundary conditions and moderating effects across demographic cohorts (e.g., digital natives versus older demographics) and institutional paradigms (e.g., legacy commercial banks versus digital neobanks). Finally, replicating this conceptual model across diverse geographic regions and economic jurisdictions will strengthen the cross-cultural generalizability and empirical robustness of the findings within the global banking domain.

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