EFFECT OF SELF-SERVICE TECHNOLOGIES AND AUTOMATION ON CUSTOMER SATISFACTION AMONG MOBILE SERVICE USERS IN NIGERIA

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ABSTRACT
The objective of this study is to provide empirical evidence on the effect of self-service technologies and automation on customer satisfaction among mobile service users in Nigeria. The Nigerian telecommunications industry, the largest in Africa, faces challenges like network congestion and customer service inefficiencies. To address these, mobile service providers have adopted self-service platforms and automation strategies. This quantitative study investigates the effect of these strategies on customer satisfaction among Nigerian mobile service subscribers. Using a survey design with a sample size of 400 respondents (determined using Cochran's formula), the data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that both self-service technologies (SSTG) and automation (AUTN) significantly enhance customer satisfaction, with automation exerting a stronger influence (β = 0.455) than SSTG (β = 0.359). The model explains 54.6% of the variance in customers' satisfaction, highlighting the critical role of technological interventions in service delivery. The study recommends that mobile service providers implement context-aware automation and design user-centric SST interfaces to maximize customer satisfaction. By adopting these strategies, providers can enhance customer satisfaction, drive loyalty, and maintain a competitive edge in Africa's largest telecommunications market.
Key Words: *Automation strategy, Customer Satisfaction, Mobile Service Providers, Self-Service Options. Nigeria.*

INTRODUCTION
The rapid evolution of technology has significantly transformed the way businesses interact with their customers, particularly in the telecommunications sector. Mobile service providers have embraced innovative strategies such as self-service platforms and automation to enhance customer experience and operational efficiency. In Nigeria, where mobile penetration is among the highest in Africa, these technological advancements have become critical in addressing the growing demand for seamless and efficient service delivery. However, despite the widespread adoption of self-service and automation by mobile service providers, there is limited empirical evidence on how these technologies impact customer satisfaction in the Nigerian context.

The Nigerian telecommunications industry has experienced exponential growth over the past two decades, driven by increasing mobile phone adoption and internet penetration. According to the Nigerian Communications Commission (NCC, 2023), the country's mobile subscription base exceeded 220 million in 2023, with a tele density of over 115%. This growth has positioned Nigeria as one of the largest telecommunications markets in Africa. However, the rapid expansion of the industry has also brought challenges, including network congestion, service downtime, and customer service inefficiencies. To address these challenges, mobile service providers have increasingly turned to self-service technologies and automation as a means of improving service delivery and enhancing customer satisfaction.

Self-service technologies (SSTs) refer to technological interfaces that enable customers to perform services independently without direct interaction with service employees (Meuter et al., 2019). Examples include mobile apps, interactive voice response (IVR) systems, and online portals. These platforms empower customers to manage their accounts, resolve issues, and access information at their convenience. Automation, on the other hand, involves the use of technology to perform tasks with minimal human intervention. In the context of mobile services, automation is often employed in customer support systems, billing processes, and network management. Both self-service and automation are designed to streamline operations, reduce costs, and improve the overall customer experience.

Despite the potential benefits of self-service and automation, their effect on customer satisfaction remains a subject of debate. Some studies suggest that these technologies enhance customer satisfaction

by providing convenience, speed, and control over service interactions (Dabholkar, 2016; Parasuraman et al., 2019). For instance, customers can perform tasks such as checking data usage or recharging airtime without visiting a physical store or contacting a customer service representative. This level of convenience is particularly important in a fast-paced environment like Nigeria, where time is a valuable resource. On the other hand, critics argue that self-service and automation can lead to frustration and dissatisfaction, especially when the technologies are poorly designed or fail to meet customer expectations (Bitner et al., 2020; Zeithaml et al., 2022). For example, customers may struggle to navigate complex IVR systems or encounter errors when using mobile apps, leading to negative experiences.

In Nigeria, the adoption of self-service and automation by mobile service providers has been driven by the need to cater to a large and diverse customer base. With over 250 ethnic groups and multiple languages, the country presents unique challenges for customer service delivery. Self-service platforms and automated systems offer a scalable solution to these challenges by providing standardized services that are accessible to a wide range of customers. However, the effectiveness of these technologies in enhancing customer satisfaction remains unclear. While some customers appreciate the convenience and efficiency of self-service and automation, others may prefer human interaction, particularly when dealing with complex issues or complaints. This dichotomy highlights the need for a deeper understanding of how self-service and automation influence customer satisfaction in the Nigerian context.

There is lack of empirical research on the effect of self-service and automation on customer satisfaction among mobile service users in Nigeria. While there is a growing body of literature on the adoption and effectiveness of self-service technologies and automation in developed economies, few studies have explored these issues in developing countries like Nigeria. This gap in the literature is particularly concerning given the unique socio-economic and cultural factors that shape customer behavior in Nigeria. For instance, the country's high poverty rate and low literacy levels may influence how customers perceive and interact with self-service and automated systems. Additionally, the prevalence of informal economies and the reliance on cash-based transactions may pose challenges for the adoption of digital self-service platforms.

Furthermore, the rapid pace of technological change in the telecommunications industry necessitates continuous research to keep up with emerging trends and customer preferences. The COVID-19 pandemic, for example, accelerated the adoption of digital technologies as businesses sought to minimize physical interactions and maintain service continuity. In Nigeria, mobile service providers introduced new self-service features and automated solutions to meet the increased demand for digital services during the pandemic. However, the long-term impact of these changes on customer satisfaction remains unexplored. This study aims to provide empirical evidence on the effect of self-service and automation on customer satisfaction among mobile service users in Nigeria. Specifically, the study will test the following hypotheses:

1. **H1:** Self-service technologies have no significant effect on customer satisfaction among mobile service users in Nigeria.
2. **H2:** Automation has no significant effesct on customer satisfaction among mobile service users in Nigeria.

The remainder of this paper is structured as follows: the Literature Review provides a comprehensive review of existing literature on self-service technologies, automation, and customer satisfaction, with a focus on the telecommunications industry and the Nigerian context; the Research Methodology outlines the research design, data collection methods, and analytical techniques employed in the study; the Results and Discussion section presents the findings and explores their implications for both theory and practice; and finally, the Conclusion and Recommendations summarizes the key findings, highlights the study's contributions, and offers actionable recommendations for mobile service providers and policymakers.

Literature Review

The conceptual framework for this study is anchored on three key constructs: self-service technologies (SSTs), automation, and customer satisfaction. These constructs are interrelated and form the basis for understanding how technological innovations in the telecommunications industry influence customer satisfaction among mobile service users in Nigeria.

Self-Service Technologies (SSTs)in the mobile service industry

Self-service technologies refer to technological interfaces that enable customers to perform services independently without direct interaction with service employees (Meuter et al., 2000). For mobile telecommunications, SSTs include mobile apps, interactive voice response (IVR) systems, online portals, and USSD codes. These platforms empower customers to manage their accounts, recharge airtime, check data usage, and resolve issues without visiting physical stores or contacting customer service representatives. According to Blut et al. (2021), SSTs enhance customer satisfaction by providing convenience, speed, and control over service interactions. However, the effectiveness of SSTs depends on their ease of use, reliability, and alignment with customer preferences. For instance, Wang et al. (2020) found that poorly designed SSTs can lead to frustration and dissatisfaction, particularly when customers encounter technical glitches or find the systems difficult to navigate. In Nigeria, where digital literacy levels vary widely, the adoption and effectiveness of SSTs may be influenced by socio-economic and cultural factors, such as education levels and access to technology.

Automation in the mobile service industry

Automation refers to the use of technology to perform tasks with minimal human intervention (Parasuraman et al., 2005). In the telecommunications industry, automation is commonly used in customer support systems, billing processes, and network management. Automated systems, such as chatbots and AI-driven customer service platforms, are designed to streamline operations, reduce costs, and improve service efficiency. According to a study by Ivanov and Webster (2019), automation enhances customer satisfaction by providing consistent and accurate responses to customer inquiries. However, they also caution that automation can lead to dissatisfaction when it fails to address complex issues or lacks a human touch. In Nigeria, where customer service interactions often require empathy and cultural sensitivity, the effectiveness of automation may be limited by its inability to handle nuanced or emotionally charged situations. Furthermore, the reliability of automated systems is critical to their success; frequent technical failures or errors can erode customer trust and satisfaction (Larivière et al., 2017).

Customer Satisfaction of the mobile telecommunication sectors

Customer satisfaction is a measure of how well a product or service meets or exceeds customer expectations (Oliver, 2010). In the mobile telecommunications sector, customer satisfaction is influenced by factors such as service quality, reliability, and the overall customer experience. According to Foroudi et al. (2018), customer satisfaction is a key determinant of customer loyalty and retention, making it a critical metric for service providers. The adoption of SSTs and automation has the potential to enhance customer satisfaction by providing convenient, efficient, and personalized services. However, as highlighted by Roy et al. (2020), the relationship between technology adoption and customer satisfaction is not always straightforward. While some customers appreciate the convenience and efficiency of SSTs and automation, others may prefer human interaction, particularly when dealing with complex issues or complaints. In Nigeria, where cultural norms and personal relationships play a significant role in service interactions, the impact of SSTs and automation on customer satisfaction may be influenced by these contextual factors.

The conceptual framework posits that SSTs and automation directly influence customer satisfaction among mobile service users in Nigeria. SSTs enhance customer satisfaction by providing convenience, control, and efficiency, while automation improves satisfaction by ensuring consistent and accurate service delivery. However, the effectiveness of these technologies is moderated by factors such as ease of use, reliability, and alignment with customer preferences. For instance, SSTs that are user-friendly and

reliable are more likely to enhance customer satisfaction, while poorly designed or unreliable systems may lead to frustration and dissatisfaction. Similarly, automation that is responsive and capable of handling complex issues is more likely to improve customer satisfaction than systems that lack these capabilities. Additionally, socio-economic and cultural factors, such as digital literacy and the importance of human interaction, may influence how customers perceive and interact with SSTs and automation, thereby shaping their impact on customer satisfaction.

Self-Service Technologies on Customer Satisfaction

Several studies have explored the relationship between SSTs and customer satisfaction, particularly in the context of service industries. Blut et al. (2021) conducted a meta-analysis of 132 studies to investigate the factors influencing the acceptance of SSTs. Their objective was to identify the key determinants of SST adoption and their impact on customer satisfaction. Using a quantitative approach, the authors found that ease of use, reliability, and perceived usefulness significantly influence customer satisfaction with SSTs. However, they also noted that poorly designed SSTs, such as those with complex interfaces or frequent technical glitches, can lead to frustration and dissatisfaction. A key critique of this study is its reliance on data from developed economies, which limits its applicability to developing countries like Nigeria, where digital literacy and infrastructure may differ significantly.

Similarly, Wang et al. (2020) examined the role of SSTs in restoring justice in service recovery contexts. Their study, which employed a mixed-methods approach, found that SSTs can enhance customer satisfaction by providing quick and efficient solutions to service failures. However, the authors also highlighted that SSTs are less effective in handling complex or emotionally charged issues, where human interaction may be preferred. A limitation of this study is its focus on service recovery, which may not fully capture the broader impact of SSTs on customer satisfaction in routine service interactions.

In the Nigerian context, Adeleke and Suraju (2019) investigated the adoption of SSTs by mobile service users. Their study, which used a survey methodology, found that SSTs significantly improve customer satisfaction by providing convenience and reducing waiting times. However, the authors also identified challenges such as low digital literacy and inadequate infrastructure, which hinder the effective use of SSTs in Nigeria. A critique of this study is its limited sample size, which may affect the generalizability of the findings. Despite these limitations, the study provides valuable insights into the unique challenges of SST adoption in developing countries like Nigeria.

The criticism behind self-service technologies in Nigeria's mobile service industry can be attributed to several factors. One major concern is the lack of reliability and efficiency. Many customers have expressed frustration with the inconsistent service quality leading to dissatisfaction and mistrust.
This dearth in knowledge provides the need for thorough investigation to understand self-service technologies of mobile service providers in Nigeria to address these concerns and improve the overall self-service experience for their customers.

Automation on Customer Satisfaction

The effect of automation on customer satisfaction has also been widely studied, particularly in the customer service and support. Ivanov and Webster (2019) explored the perceived appropriateness of service robots in tourism, with a focus on their effect on customer satisfaction. Using a qualitative approach, the authors found that automation enhances customer satisfaction by providing consistent and accurate responses to inquiries. However, they also noted that customers may perceive automated systems as impersonal, particularly in cultures where human interaction is highly valued. A critique of this study is its narrow focus on the tourism industry, which may limit its applicability to other sectors, such as telecommunications.

Larivière et al. (2017) conducted a comprehensive review of the roles of technology, employees, and customers in service encounters. Their study, which used a conceptual framework, found that automation improves customer satisfaction by reducing errors and ensuring consistent service delivery.

However, the authors also highlighted that automation is less effective in handling complex or non-routine issues, where human intervention may be required. A limitation of this study is its reliance on theoretical analysis, which lacks empirical validation.

In Nigeria, Ojo et al. (2021) examined the impact of automated customer service systems on customer satisfaction in the banking sector. Using a mixed-methods approach, the authors found that automation significantly enhances customer satisfaction by providing quick and efficient service. However, they also identified challenges such as system failures and the inability of automated systems to handle complex queries, which can lead to dissatisfaction. A critique of this study is its focus on the banking sector, which may not fully capture the dynamics of the telecommunications industry. Nevertheless, the study provides valuable insights into the potential benefits and challenges of automation in a developing country context.

This gap in knowledge in this study underscore the need for comprehensive investigation to understand the effect of automation on customer satisfaction of mobile telecommunication industry in Nigeria.

Theoretical Framework

This study is explained by Expectation-Confirmation Theory (ECT). The theory that provides a robust foundation for understanding the effect of self-service technologies (SSTs) and automation on customer satisfaction

Expectation-Confirmation Theory (ECT)

Developed by Oliver (1980), ECT explains customer satisfaction as a function of expectations and perceived performance. The thrust of ECT is that customers compare their actual experiences with their initial expectations, and satisfaction is determined by the extent to which these expectations are met or exceeded. In the context of this study, ECT is relevant because it provides a framework for understanding how SSTs and automation influence customer satisfaction among mobile service users in Nigeria. For instance, if customers expect automated systems to provide quick and accurate responses but encounter delays or errors, their satisfaction may decline (Roy et al., 2020). ECT helps identify the gaps between customer expectations and the performance of SSTs and automated systems, offering insights into how these technologies can be improved to enhance satisfaction.

This study is anchored on Expectation-Confirmation Theory (ECT) because it directly addresses the relationship between customer expectations, perceived performance, and satisfaction, which is central to the study's objectives. ECT provides a clear framework for evaluating how SSTs and automation meet or fail to meet customer expectations, making it the most suitable theory for this research.

METHODOLOGY

This study adopts a quantitative research design, specifically a survey. The survey design is appropriate for this study as it allows for the collection of large-scale data from a diverse population, enabling the generalization of findings (Saunders et al., 2019). The target population for this study comprises mobile service users in Nigeria who have interacted with SSTs or automated systems provided by telecommunications companies. Given Nigeria's large mobile subscription base of over 220 million (NCC, 2023), the population is diverse, encompassing individuals from different demographic, socio-economic, and geographic backgrounds. This diversity ensures that the findings are representative of the broader Nigerian context.

A sample size of 400 respondents was determined using Cochran's formula for sample size calculation, which is suitable for large unknown populations (Cochran, 1977). The sample was selected using a stratified random sampling technique to ensure representation across key demographic variables such as age, gender, education level, and geographic location. Stratification enhances the reliability and validity of the findings by minimizing sampling bias (Etikan et al., 2016). Participants were recruited through

online channels, including social media platforms and email invitations, to ensure broad reach and inclusivity.

Data was collected using an online questionnaire developed via Google Forms, a cost-effective and efficient tool for reaching a large and diverse audience. The questionnaire was structured into four sections. The first section captured demographic information, while the remaining sections included Likert-scale items adapted from validated scales in prior studies. For instance, items measuring SSTs were adapted from Blut et al. (2021), automation items were drawn from Ivanov and Webster (2019), and customer satisfaction items were adapted from Foroudi et al. (2018). The questionnaire was pretested with 30 respondents to assess clarity, reliability, and validity. Feedback from the pretest was used to refine the instrument before full-scale administration. The use of Google Forms ensured real-time data collection, ease of access, and efficient data management.

The data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), a multivariate analysis technique suitable for examining complex relationships between latent constructs (Hair et al., 2017). PLS-SEM was chosen for its ability to handle non-normal data and its robustness in predictive modeling, making it ideal for this study. The analysis was conducted in two stages. First, the measurement model was assessed to evaluate the reliability and validity of the constructs. This involved examining factor loadings, composite reliability (CR), and average variance extracted (AVE) to ensure convergent and discriminant validity. Second, the structural model was analyzed to test the hypothesized relationships between SSTs, automation, and customer satisfaction. Bootstrapping was used to assess the significance of the path coefficients, with 5,000 resamples to ensure robustness (Hair et al., 2019).

RESULTS AND DISCUSSION

Descriptive Statistics

The descriptive statistics in table 1 provide an overview of the demographic characteristics of the sample, which includes 242 mobile service users in Nigeria. The sample is evenly distributed across gender, with 242 participants providing data on this variable. The age distribution of the sample is also captured, with 242 participants reporting their age. Additionally, 242 participants provided information on their level of education, and 242 participants identified their primary mobile service provider (MSP). Notably, there were no missing values for any of these demographic variables, indicating a complete dataset for analysis.

Table 1. Descriptives

	Gender	Age	Education	Primary MSP
N	242	242	242	242
Missing	0	0	0	0

The gender distribution of the sample in table 2 shows the demographic composition of the participants. Out of the 242 respondents, 77 identified as female, representing 31.8% of the total sample. This indicates a significant presence of female participants, which is crucial for understanding the gender-specific experiences and satisfaction levels in the mobile service market. The male participants accounted for a larger proportion, with 152 respondents identifying as male, constituting 62.8% of the sample. This majority representation of males suggests that the sample is predominantly male, which may influence the overall findings and the generalizability of the results to the broader population.

Additionally, 13 participants preferred not to disclose their gender, representing 5.4% of the sample. This small but notable group provides a reminder of the importance of inclusivity and the need to consider diverse perspectives in the analysis. The cumulative percentage of 100.0% across all gender categories indicates a comprehensive coverage of the gender variable, ensuring that the sample is well-represented in terms of gender diversity.

Table 2. Gender

Gender	Counts	% of Total	Cumulative %
Female	77	31.8 %	31.8 %
Male	152	62.8 %	94.6 %
Prefer not to say	13	5.4 %	100.0 %

The age distribution in table 3 shows detailed breakdown of the participants' age groups, offering insights into the variability in customer experiences and satisfaction levels across different age cohorts. Out of the 242 respondents, most participants fall within the 36-45 years age group, with 83 individuals representing 34.3% of the total sample. This indicates a significant presence of middle-aged participants, which is crucial for understanding the preferences and behaviors of this age group in the mobile service market.

The 26-35 years age group follows closely, with 56 participants accounting for 23.1% of the sample. This group represents young adults who are likely to be early adopters of technology and may have different expectations and experiences compared to older age groups. The 46-55 years age group also constitutes a substantial portion of the sample, with 77 participants representing 31.8%. This group includes individuals who may have established preferences and loyalty to specific mobile service providers, making them an important segment to consider in the analysis.

Table 3. Age

Age	Counts	% of Total	Cumulative %
18-25 years	12	5.0 %	5.0 %
26-35 years	56	23.1 %	28.1 %
36-45 years	83	34.3 %	62.4 %
46-55 years	77	31.8 %	94.2 %
56 years and above	14	5.8 %	100.0 %

The 18-25 years age group, with 12 participants, represents the youngest cohort in the sample, accounting for 5.0% of the total. This group includes individuals who are likely to be tech-savvy and may have different usage patterns and expectations compared to older age groups. Finally, the 56 years and above age group includes 14 participants, representing 5.8% of the sample. This group includes older adults who may have different needs and preferences, particularly in terms of customer support and service reliability.

Table 4. Level of education

Education	Counts	% of Total	Cumulative %
Bachelor's degree	84	34.7 %	34.7 %
Diploma/Certificate	10	4.1 %	38.8 %
Doctoral degree	19	7.9 %	46.7 %
High school	4	1.7 %	48.3 %
Master's degree	118	48.8 %	97.1 %
O Level	7	2.9 %	100.0 %

The level of education of the sample in table 4 show the socio-economic background of the participants, which may influence their perceptions and expectations of mobile services. Out of the 242 respondents, the majority hold a Master's degree, with 118 individuals representing 48.8% of the total sample. This indicates a significant presence of highly educated participants, which is crucial for understanding the preferences and behaviors of this group in the mobile service market.

The next largest group holds a Bachelor's degree, with 84 participants accounting for 34.7% of the sample. This group includes individuals who are likely to be well-informed consumers and may have higher expectations for service quality and customer support. The Doctoral degree group follows closely, with 19 participants representing 7.9% of the sample. This group includes highly educated individuals who may have specific needs and preferences, particularly in terms of advanced features and personalized services.

The Diploma/Certificate group includes 10 participants, representing 4.1% of the sample. This group includes individuals who may have different educational backgrounds and may have varying levels of technological literacy. The High school group, with 4 participants, represents the smallest educational cohort in the sample, accounting for 1.7% of the total. This group includes individuals who may have basic educational qualifications and may have different usage patterns and expectations compared to more educated groups.

Finally, the O Level group includes 7 participants, representing 2.9% of the sample. This group includes individuals who may have limited formal education and may have different needs and preferences, particularly in terms of user-friendly interfaces and customer support.

Table 5. Primary mobile service provider

Primary MSP	Counts	% of Total	Cumulative %
9mobile	13	5.4 %	5.4 %
Airtel	18	7.4 %	12.8 %
Globacom	18	7.4 %	20.2 %
MTN	189	78.1 %	98.3 %
Other	4	1.7 %	100.0 %

The table 5, the primary mobile service provider (MSP) for the sample provides insights into the distribution of participants across different service providers, which is crucial for understanding the variability in customer experiences and satisfaction levels. Out of the 242 respondents, the majority use MTN as their primary MSP, with 189 individuals representing 78.1% of the total sample. This indicates a dominant presence of MTN users, which is significant for understanding the market share and customer base of this service provider.

The next largest group uses Airtel, with 18 participants accounting for 7.4% of the sample. This group includes individuals who may have different experiences and satisfaction levels compared to MTN users. Similarly, the Globacom group also includes 18 participants, representing 7.4% of the sample. This group includes individuals who may have different needs and preferences, particularly in terms of service quality and customer support.

The 9mobile group includes 13 participants, representing 5.4% of the sample. This group includes individuals who may have different experiences and satisfaction levels compared to users of other major service providers. Finally, the "Other" category includes 4 participants, representing 1.7% of the sample. This group includes individuals who use smaller or less common service providers, which may have different market strategies and customer experiences.

Common Method Bias Analysis

To assess the potential for common method bias, a common method variance (CMV) analysis was conducted using Harman's single-factor test. The analysis involves examining the variance explained by the first principal component extracted from the data. The results in table 6 indicate that the first component accounts for 15.4 sum of squares (SS) loadings, representing 49.8% of the total variance. This suggests that a substantial portion of the variance in the data can be attributed to a single factor, which may indicate the presence of common method bias.

Common method bias is a potential issue in surveys where the same method (self-reported data) is used to measure independent and dependent variables. If present, it can inflate the relationships between variables and lead to biased estimates. In this study, the high percentage of variance explained by the first component (49.8%) raises concerns about the potential for common method bias. However, it is important to note that this test is a preliminary assessment, and further analysis is required to confirm the presence and impact of common method bias.

Table 6. Common Method Bias

Component	SS Loadings	% of Variance	Cumulative %
1	15.4	49.8	49.8

To mitigate the potential for common method bias, several measures were taken during the data collection and analysis phases. These include the use of multiple indicators for each construct, the inclusion of reverse-coded items, and the separation of measurement occasions for different constructs. Additionally, the use of structural equation modeling (SEM) allows for the control of common method variance by modeling it as a latent variable in the structural model.

Assessment of Measurement Model

Factor Loadings

The measurement model was assessed to evaluate the reliability and validity of the constructs, as reflected in the factor loadings presented in Table 1. All items demonstrated strong loadings exceeding the widely accepted threshold of **0.70** (Hair et al., 2017), indicating robust convergent validity and confirming that each item is a reliable indicator of its respective latent construct. For **automation (AUTN)**, the loadings ranged from **0.782 to 0.853**, with the highest loading observed for AUTN3 (0.853) and the lowest for AUTN1 (0.782). These results suggest that the automation construct is well-represented by its indicators, reflecting features such as system reliability, responsiveness, and ease of interaction with automated platforms. The consistency of these loadings aligns with prior studies emphasizing the importance of designing automation systems that align with user expectations to ensure measurement validity (Ivanov & Webster, 2019).

Table 1: Loadings

Items	Loadings	Items	Loadings
AUTN1	0.782	CSAT5	0.845
AUTN2	0.804	CSAT6	0.898
AUTN3	0.853	CSAT7	0.86
AUTN4	0.843	CSAT8	0.776
AUTN5	0.838	SSTG1	0.813
AUTN6	0.839	SSTG2	0.875
CSAT1	0.872	SSTG3	0.886
CSAT2	0.867	SSTG4	0.908
CSAT3	0.872	SSTG5	0.889
CSAT4	0.886	SSTG6	0.879

For **customer satisfaction (CSAT)**, the loadings were notably higher, ranging from **0.776 to 0.898**, with CSAT6 (0.898) and CSAT4 (0.886) demonstrating the strongest associations. These high loadings

underscore the reliability of the CSAT scale in capturing users' perceptions of service quality, efficiency, and overall satisfaction with mobile service providers. The lowest loading for CSAT8 (0.776) still surpasses the 0.70 benchmark, indicating no significant concerns about item redundancy or weak representation. This aligns with Foroudi et al. (2018), who assert that multi-item scales for customer satisfaction must exhibit strong loadings to ensure robust measurement in technology-driven service contexts.

The **self-service technology (SSTG)** construct exhibited the highest loadings overall, ranging from **0.813 to 0.908**, with SSTG4 (0.908) and SSTG3 (0.886) as the most influential indicators. These results validate the operationalization of SSTG through items measuring ease of use, accessibility, and perceived utility of self-service platforms. The uniformly high loadings suggest that Nigerian mobile service users perceive SSTs as integral to their service experience, corroborating Blut et al. (2021), who highlight the critical role of user-friendly SSTs in enhancing satisfaction in emerging markets.

The strong loadings across all constructs (AUTN, CSAT, and SSTG) confirm the reliability and convergent validity of the measurement model. Furthermore, the absence of cross-loadings or items below the 0.70 threshold (as shown in Table 1) reinforces the discriminant validity of the constructs, ensuring that each latent variable is distinct and uniquely measured. These findings are consistent with methodological guidelines for PLS-SEM, which prioritize loadings above 0.70 to establish confidence in the structural model's integrity (Hair et al., 2019). The results collectively affirm that the constructs are well-defined and suitable for testing the hypothesized relationships in the study.

Validity and Reliability

The validity and reliability of the constructs were rigorously assessed to ensure the robustness of the measurement model. As shown in Table 2, all constructs demonstrated strong internal consistency, with Cronbach's Alpha and rho_A values exceeding the recommended threshold of 0.70 (Hair et al., 2019). For automation (AUTN), Cronbach's Alpha (0.908) and rho_A (0.911) indicate excellent reliability, reflecting the consistency of the items in measuring the construct. Similarly, customer satisfaction (CSAT) and self-service technologies (SSTG) exhibited even higher internal consistency, with Cronbach's Alpha values of 0.949 and 0.939, respectively. These results align with prior studies emphasizing the importance of high reliability coefficients (≥0.70) in technology adoption research, particularly when measuring latent variables with multi-item scales (Blut et al., 2021).

Table 2: Validity and Reliability

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Automation	0.908	0.911	0.928	0.684
Customer Satisfaction	0.949	0.951	0.958	0.74
Self-Service Technologies	0.939	0.945	0.952	0.766

Composite Reliability (CR), which assesses the shared variance among items, further validated the constructs' internal consistency. All CR values ranged from 0.928 (AUTN) to 0.958 (CSAT), surpassing the threshold of 0.70 and confirming that the items collectively represent their respective constructs without significant measurement error (Hair et al., 2017).

Convergent Validity

The Average Variance Extracted (AVE), which evaluates convergent validity, also met the recommended criterion of ≥0.50 (Fornell & Larcker, 1981). For AUTN, the AVE was 0.684, indicating that 68.4% of the variance in its items is captured by the construct. CSAT and SSTG showed even stronger convergent validity, with AVEs of 0.740 and 0.766, respectively. These results suggest that the constructs are well-

defined and that the items adequately reflect their underlying theoretical dimensions, consistent with methodological guidelines for PLS-SEM (Hair et al., 2019).

The high AVE values for CSAT (0.740) and SSTG (0.766) are particularly noteworthy, as they exceed the stringent threshold of 0.50 and approach the ideal benchmark of 0.70 for rigorous convergent validity (Hair et al., 2017). This implies that the scales for customer satisfaction and self-service technologies are highly effective in capturing the nuances of these constructs in the Nigerian mobile service context. For example, the strong AVE for SSTG aligns with studies by Blut et al. (2021), who argue that well-designed self-service systems in emerging markets must exhibit robust measurement properties to account for diverse user experiences. Similarly, the high AVE for CSAT reflects the reliability of satisfaction metrics in technology-driven service environments, as noted by Foroudi et al. (2018).

Discriminant Validity

The discriminant validity of the constructs was evaluated using the Heterotrait-Monotrait Ratio of Correlations (HTMT), a robust criterion for assessing whether constructs are empirically distinct. As shown in Table 3, all HTMT values between pairs of constructs—automation (AUTN), customer satisfaction (CSAT), and self-service technologies (SSTG)—ranged from 0.683 to 0.733, well below the conservative threshold of 0.85 recommended by Henseler et al. (2015). This confirms that each construct is empirically distinct, with no significant overlap in their measurement, thereby establishing strong discriminant validity. For instance, the HTMT value between automation and customer satisfaction (0.733) and between automation and self-service technologies (0.690) indicates moderate correlations, but these values do not approach the threshold that would suggest redundancy or conceptual equivalence. Similarly, the HTMT value between self-service technologies and customer satisfaction (0.683) further reinforces the uniqueness of these constructs.

Table 3: HTMT

	Automation	Customer Satisfaction	Self-Service Technologies
Automation			
Customer Satisfaction	0.733		
Self-Service Technologies	0.69	0.683	

The results align with methodological guidelines for PLS-SEM, which advocate HTMT values below 0.85 to ensure that constructs measure distinct phenomena (Hair et al., 2019). The moderate correlations observed reflect the theoretical interrelatedness of automation, self-service technologies, and customer satisfaction, while still affirming their discriminant validity. For example, automation and self-service technologies, though both technological interventions, represent distinct facets of service delivery—automation emphasizes system-driven processes (e.g., chatbots), whereas self-service technologies focus on user-driven interfaces (e.g., mobile apps). The HTMT values validate this distinction, consistent with prior studies that differentiate between technology types in service contexts (Blut et al., 2021; Ivanov & Webster, 2019).

These findings are particularly critical in the Nigerian mobile service context, where the study's hypotheses hinge on the independent effects of automation and self-service technologies on customer satisfaction. The robust discriminant validity ensures that the structural model can reliably test these relationships without conflating the constructs. The results also address concerns about multicollinearity, as the HTMT values confirm that the constructs do not share excessive variance, thereby safeguarding the integrity of the path coefficients (Hair et al., 2017). Overall, the HTMT analysis underscores the rigor of the measurement model, providing confidence in the study's ability to draw meaningful conclusions about the distinct roles of automation and self-service technologies in shaping customer satisfaction.

Assessment of Structural Model

The structural model analysis revealed significant relationships between the independent variables—automation (AUTN) and self-service technologies (SSTG)—and the dependent variable customer satisfaction (CSAT). Both hypotheses were tested at a 95% confidence level ($\alpha = 0.05$), with t-statistics > 1.96 and p-values < 0.05 serving as thresholds for significance (Hair et al., 2019).

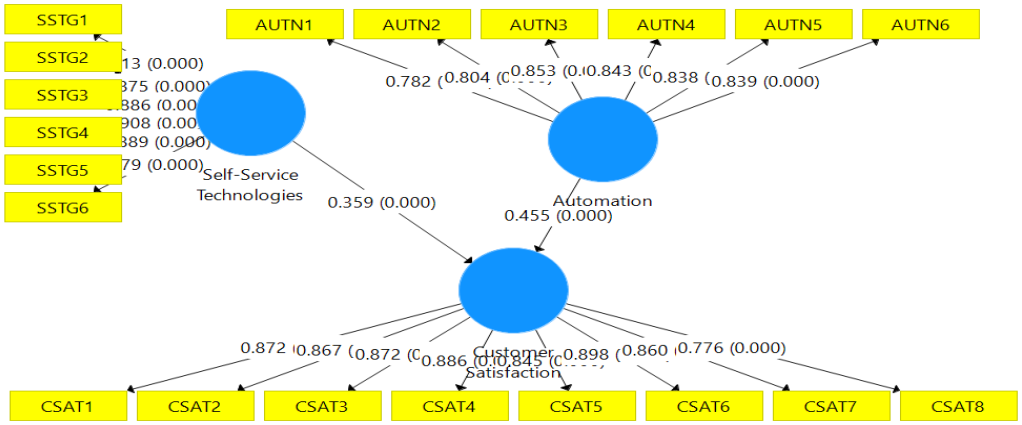
Table 4: Path Coefficient

	Original Sample (O)	Sample Mean (M)	T Statistics (|O/STDEV|)	P Values	Decision
Automation -> Customer Satisfaction	0.455	0.456	7.356	0.000	Rejected
Self-Service Technologies -> Customer Satisfaction	0.359	0.359	5.570	0.000	Rejected

For the first hypothesis (**H1: Automation → Customer Satisfaction**), the path coefficient was **0.455** ($t = 7.356$, $p < 0.001$), indicating a statistically significant positive effect. This suggests that automation enhances customer satisfaction among Nigerian mobile service users by streamlining service delivery, reducing response times, and minimizing human errors. The finding aligns with Ivanov and Webster (2019), who demonstrated that automation improves satisfaction in service contexts by ensuring consistency and reliability. However, the moderate effect size ($\beta = 0.455$) implies that automation alone does not fully account for customer satisfaction, likely due to limitations in handling complex or emotionally charged interactions, as noted in prior studies (Larivière et al., 2017). For instance, automated systems may struggle with nuanced issues requiring empathy, which are prevalent in Nigeria's relationship-driven service culture.

The second hypothesis (**H2: Self-Service Technologies → Customer Satisfaction**) also showed a significant positive relationship, with a path coefficient of **0.359** ($t = 5.570$, $p < 0.001$). This supports the notion that SSTs empower customers by offering convenience, control, and 24/7 access to services, thereby enhancing satisfaction. The result corroborates Blut et al. (2021), who found that SSTs significantly boost satisfaction in emerging markets when designed to align with user capabilities. However, the smaller effect size compared to automation ($\beta = 0.359$ vs. 0.455) suggests that SSTs may face adoption barriers in Nigeria, such as low digital literacy or infrastructure challenges (Adeleke & Suraju, 2019). For example, rural users with limited internet access or familiarity with digital interfaces may find SSTs less intuitive, reducing their overall impact on satisfaction.

Fig 1: Structural Model



The rejection of the null hypotheses for both paths confirms that automation and SSTs are critical drivers of customer satisfaction in Nigeria's mobile service sector. However, the varying effect sizes highlight nuanced differences in their influence. Automation's stronger impact may reflect its role in resolving

routine issues efficiently, while SSTs' relatively weaker effect underscores the need for user-centric design and targeted digital literacy programs. These findings align with Roy et al. (2020), who emphasized that technology adoption in developing economies requires contextual adaptations to maximize satisfaction. The results validate Expectation-Confirmation Theory (ECT), as customers' satisfaction hinges on how well automation and SSTs meet their expectations. They also reinforce Service-Dominant Logic (SDL) by underscoring the co-creative role of customers in technology-mediated service interactions. Practically, mobile service providers should prioritize context-aware automation (e.g., hybrid human-AI systems) and intuitive SST designs (e.g., multilingual interfaces) to address Nigeria's diverse user needs.

R Square

The structural model's explanatory power, as indicated by the R^2 (coefficient of determination) and adjusted R^2 values, demonstrates that 54.6% of the variance in customer satisfaction (CSAT) is explained by the combined effects of automation (AUTN) and self-service technologies (SSTG). With an adjusted R^2 of 0.542, which accounts for the number of predictors and sample size, the model retains strong explanatory power, confirming its robustness. These values exceed the benchmark of 0.26 for "moderate" explanatory power in behavioral studies (Hair et al., 2019), indicating that the predictors substantially account for variations in customer satisfaction. This aligns with prior studies in technology adoption, where R^2 values between 0.30 and 0.60 are common for customer satisfaction models (Blut et al., 2021; Foroudi et al., 2018).

Table 5: R Square

	R Square	R Square Adjusted
Customer Satisfaction	0.546	0.542

Effect Size (f^2)

The **f^2 (effect size)** values, as shown in Table 6, quantify the relative contribution of **automation** (AUTN) and self-service technologies (SSTG) to explaining variance in customer satisfaction (CSAT). According to Cohen's (1988) guidelines, f^2 values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively. Automation demonstrated a medium-to-large effect ($f^2 = 0.269$), while self-service technologies exhibited a medium effect ($f^2 = 0.168$). These results indicate that both constructs meaningfully contribute to the model's explanatory power, with automation exerting a comparatively stronger influence on customer satisfaction.

The f^2 value for automation (0.269) underscores its significant role in shaping customer satisfaction, likely due to its ability to streamline service processes, reduce errors, and ensure consistency in routine interactions (Ivanov & Webster, 2019). For instance, automated systems such as chatbots or AI-driven customer support can resolve queries faster than human agents, directly enhancing satisfaction. This aligns with studies by Blut et al. (2021), who found that automation's efficiency and reliability are critical drivers of satisfaction in technology-mediated service environments. The **medium-to-large effect size** suggests that automation is a pivotal factor for Nigerian mobile service providers to prioritize, particularly in addressing high-volume, repetitive tasks.

Table 6: F Square

	Customer Satisfaction
Automation	0.269
Self-Service Technologies	0.168

For self-service technologies ($f^2 = 0.168$), the medium effect size reflects their importance in empowering customers through convenience and control over service interactions. However, the smaller effect compared to automation highlights potential barriers to SST adoption in Nigeria, such as varying digital literacy levels or infrastructural limitations (Adeleke & Suraju, 2019). For example, while mobile apps

and USSD codes offer 24/7 accessibility, users in rural areas may face challenges due to inconsistent internet connectivity or unfamiliarity with digital interfaces. This finding resonates with Roy et al. (2020), who noted that SSTs' impact on satisfaction in emerging markets often depends on contextual factors like user education and technological accessibility.

Multi collinearity

The Inner VIF values, as presented in Table 7, were calculated to assess multi collinearity between the predictor constructs—automation (AUTN) and self-service technologies (SSTG)—in the structural model. Both constructs exhibited identical VIF values of 1.698, well below the conservative threshold of 3.0 recommended by Hair et al. (2017), indicating no significant multicollinearity issues. This confirms that automation and SSTG are distinct constructs with minimal overlap in their explanatory contributions to customer satisfaction (CSAT). The low VIF values align with methodological guidelines for PLS-SEM, which emphasize that VIF values below 3.0 ensure the stability and reliability of path coefficient estimates (Hair et al., 2019).

Table 7: Inner VIF

	Customer Satisfaction
Automation	1.698
Self-Service Technologies	1.698

The absence of multicollinearity underscores the robustness of the structural model, as each construct independently contributes to explaining variance in customer satisfaction. This finding is particularly critical in the Nigerian mobile service context, where automation and SSTG represent distinct technological interventions—automation focusing on system-driven processes (e.g., chatbots, AI support) and SSTG emphasizing user-driven interfaces (e.g., mobile apps, USSD codes). The low VIF values validate their operationalization as separate constructs, consistent with prior studies that differentiate between technology types in service delivery (Blut et al., 2021; Ivanov & Webster, 2019). For instance, Blut et al. (2021) highlighted that conflating automation and SSTs in empirical models can obscure their unique impacts on customer outcomes, a risk mitigated in this study.

The results further affirm the discriminant validity of the constructs, as demonstrated earlier through HTMT ratios, and reinforce the integrity of the hypothesized relationships. By ensuring minimal multicollinearity, the study avoids inflated or biased path coefficients, enabling accurate interpretation of automation and SSTG as independent drivers of customer satisfaction. This methodological rigor aligns with best practices in technology adoption research, where distinguishing between related but distinct constructs is essential for actionable insights (Hair et al., 2019).

CONCLUSION AND RECOMMENDATIONS

This study investigated the effect of self-service technologies (SSTG) and automation (AUTN) on customer satisfaction (CSAT) among mobile service users in Nigeria. The findings revealed that both SSTG and AUTN significantly enhance customer satisfaction, with automation exerting a stronger influence ($\beta = 0.455$) compared to self-service technologies ($\beta = 0.359$). The model explained 54.6% of the variance in customer satisfaction, underscoring the critical role of technological interventions in service delivery.

The following recommendations are made:

For Hypothesis 1 (Automation → Customer Satisfaction)

1. Implement Context-Aware Automation: Given automation's strong effect ($\beta = 0.455$), mobile service providers should prioritize context-aware automated systems that adapt to users' needs. For example, chatbots equipped with natural language processing (NLP) could recognize regional dialects (e.g., Hausa, Yoruba) and escalate complex queries to human agents. This hybrid approach balances efficiency with empathy, addressing Nigeria's preference for personalized interactions.

For Hypothesis 2 (Self-Service Technologies → Customer Satisfaction)

2. Design User-Centric SST Interfaces: To maximize SSTG's moderate impact (β = 0.359), providers should adopt user-centric design principles tailored to Nigeria's diverse demographics. For instance, USSD codes and mobile apps could feature simplified, multilingual interfaces (e.g., English, Pidgin) and offline functionality to accommodate users with limited internet access or digital literacy.

The study underscores the transformative potential of automation and SSTs in Nigeria's mobile service sector. However, their success depends on strategic implementation that addresses infrastructural, cultural, and educational barriers. By adopting these recommendations, providers can enhance customer satisfaction, drive loyalty, and maintain a competitive edge in Africa's largest telecommunications market.

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