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Assessing The Impact of Performance Metrics Optimization on Service Quality and Customer Satisfaction in The Nigerian Telecommunications Industry

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Abstract- ***The Nigerian telecommunications industry has experienced remarkable growth over the past two decades, becoming one of the largest mobile markets in Africa. However, persistent challenges such as poor network quality, frequent call drops, congestion, and unresolved customer complaints continue to undermine service delivery and erode customer satisfaction. This study evaluates the impact of optimizing key performance metrics—including Call Setup Success Rate (CSSR), Call Drop Rate (CDR), Handover Success Rate (HOSR), and signal strength—on both service quality and customer satisfaction within Nigeria's mobile sector. A mixed-methods research design was employed, relying on secondary data drawn from the Nigerian Communications Commission (NCC) Quality of Service reports (2022–2023), GSMA publications, and a dataset of 4,327 customer complaints lodged with consumer protection agencies. Data analysis was carried out using Microsoft Excel for KPI computation and SPSS for statistical testing, including ANOVA to compare operator performance. Results indicate that MTN and Airtel consistently outperformed Glo and 9mobile in CSSR and HOSR, yet none of the operators met NCC's benchmark for CDR. Analysis of complaints further revealed that billing irregularities and poor customer service responsiveness were the dominant drivers of dissatisfaction, surpassing even technical network failures. The findings demonstrate that optimizing technical KPIs alone does not guarantee improved customer satisfaction; effective complaint resolution and transparent customer engagement mechanisms are equally critical. The study concludes that sustainable satisfaction requires a dual strategy combining network quality enhancement with robust customer relationship management. Limitations of this study include reliance on secondary data and the exclusion of real-time proprietary operator datasets, which may provide deeper insights. Future research should incorporate predictive analytics and machine learning approaches to monitor QoS trends and forecast customer churn, offering more proactive strategies for improving service quality in Nigeria's telecommunications sector***

Keywords: ***Performance Metrics, Service Quality, Customer Satisfaction, Telecommunications, Nigeria***

I. INTRODUCTION

The Nigerian telecommunications sector has experienced unprecedented transformation since liberalization in the early 2000s. Deregulation opened the market to private investment, resulting in rapid infrastructure expansion, mobile penetration, and increased competition among service providers [1]. This growth has made Nigeria one of the largest telecommunications markets in Africa, with mobile services contributing significantly to GDP growth and digital inclusion [2].

The deployment of 4G/LTE and pilot 5G rollouts have further enhanced connectivity, creating new opportunities for e-commerce, e-governance, and financial inclusion. Nevertheless, the sustainability of this growth trajectory is increasingly challenged by persistent service quality problems that directly affect user experience.

Despite heavy investment in infrastructure, consumers continue to grapple with dropped calls, poor indoor coverage, frequent network outages, and slow internet speeds. Billing irregularities, unsolicited deductions, and unresolved complaints compound these issues, creating a perception of unreliability among subscribers.

These challenges undermine customer trust and discourage long-term loyalty, which are crucial in a highly competitive and saturated market. Moreover, the disparity between urban and rural access highlights persistent inequalities in service delivery, with underserved regions experiencing weaker signals and limited broadband access compared to metropolitan areas.

The relationship between service quality dimensions and customer loyalty has been a focal point of research within the Nigerian telecommunications context. Alabar & Gbande, (2017) [3] examined this relationship using the SERVQUAL model and found that dimensions such as tangibles, reliability, responsiveness, assurance, and empathy have a significant positive correlation with customer loyalty.

This suggests that enhancing these service quality aspects can lead to increased customer retention and loyalty.

Several factors contribute to these service quality issues. Infrastructure deficits, including inadequate base stations and limited fiber-optic networks, impede the ability to provide reliable coverage.

Additionally, inconsistent power supply and multiple taxation policies increase operational costs for telecom companies, further affecting service delivery. Regulatory challenges, such as bureaucratic processes and delays in policy implementation, also pose significant obstacles to timely infrastructure development and service improvements [2].

As customer expectations continue to rise, telecom companies must optimize their performance metrics to remain competitive. Implementing data-driven strategies to monitor and enhance key performance indicators (KPIs) like network uptime, call success rates, and data speeds can lead to improved customer satisfaction.

Moreover, simplifying tariff structures and improving billing transparency are essential steps toward addressing prevalent consumer complaints. Collaborative efforts between operators, regulators, and other stakeholders are crucial to overcoming these challenges and ensuring the sustainable growth of Nigeria's telecommunications industry [3].

To address these systemic problems, the Nigerian Communications Commission (NCC) has developed regulatory benchmarks to monitor operator compliance with international standards [4].

Indicators such as Call Setup Success Rate (CSSR), Call Drop Rate (CDR), Handover Success Rate (HOSR), and signal strength form the backbone of QoS measurement in Nigeria. These benchmarks are intended to standardize performance expectations and hold operators accountable to consumers.

However, empirical studies consistently show that operators fall short of these minimum requirements, particularly during peak demand periods and in areas with limited infrastructure deployment [5]. The gap between regulatory benchmarks and actual operator performance raises questions about enforcement and transparency.

While fines and sanctions have occasionally been imposed, network operators often attribute underperformance to structural barriers such as power supply instability, right-of-way issues, and high operating costs.

Nonetheless, the persistence of these challenges signals an urgent need for more innovative solutions and better alignment between regulatory oversight and operator strategies. Research also shows that regulatory interventions alone cannot address consumer dissatisfaction if complaint resolution mechanisms remain weak and unresponsive [6].

Existing studies have emphasized service quality but rarely establish quantitative links between technical performance metrics and customer satisfaction outcomes in Nigeria. On one hand, technical analyses

have focused on measuring network performance using KPIs and comparing operator compliance with NCC standards [7].

On the other hand, customer perception studies have investigated satisfaction and loyalty, emphasizing subjective experiences such as trust, responsiveness, and perceived fairness. The lack of integration between these approaches creates a research gap, as consumer dissatisfaction cannot be fully explained without simultaneously considering both technical network efficiency and customer relationship management practices.

This study seeks to bridge that gap by evaluating how the optimization of QoS metrics translates into measurable improvements in customer satisfaction within the Nigerian context [8]. By combining performance data with consumer complaint analysis, the research provides a holistic perspective on the state of telecommunications services.

Such an approach is essential not only for understanding the limitations of existing systems but also for informing practical strategies that enhance service delivery. Integrating both technical and perceptual dimensions of quality ensures that recommendations are grounded in the realities of both operators and end-users, contributing to more sustainable customer satisfaction and loyalty in Nigeria's dynamic telecommunications landscape [9, 10].

Despite significant investments in telecommunications infrastructure and regulatory oversight, Nigerian mobile subscribers continue to experience substandard service quality.

Network congestion, frequent call drops, unresolved billing complaints, and poor customer service responsiveness remain widespread. This situation reveals a misalignment between operator-defined KPIs and customer expectations [4, 8]. While NCC benchmarks provide measurable standards, operators' underperformance and weak complaint resolution mechanisms contribute to persistent dissatisfaction and customer churn.

Therefore, there is a pressing need to evaluate the relationship between optimizing performance metrics and improving customer satisfaction outcomes in the Nigerian telecommunications industry.

The aim of this study is to assess the impact of optimizing key QoS performance metrics on service quality and customer satisfaction among Nigerian telecommunications operators. The specific objectives are to:

- Measure the performance of mobile operators in Nigeria against NCC QoS benchmarks.
- Analyze customer complaint data to identify major drivers of dissatisfaction.
- Evaluate the extent to which optimization of KPIs improves customer satisfaction.
- Compare operator performance with existing studies and global benchmarks.
- Provide recommendations for network operators and regulators to enhance service delivery.

The rest of this paper is structured as follows: Section 2 reviews existing literature on service quality, customer satisfaction, and QoS in telecommunications. Section 3 presents the research methodology, including data sources, KPI definitions, and analysis techniques.

Section 4 discusses the results, including operator performance against benchmarks and comparative analysis. Section 5 outlines the study's limitations, while Section 6 provides conclusions and recommendations for future work.

II. LITERATURE REVIEW

The Nigerian telecommunications industry has undergone significant transformation since the early 2000s, emerging as one of the fastest-growing sectors in Africa. This growth has been primarily driven by major operators such as MTN Nigeria Communications PLC, Airtel Networks Limited (Airtel Africa PLC), Globacom Limited, and 9mobile (Emerging Markets Telecommunication Services Ltd), which have expanded their services to meet the increasing demand for mobile and internet connectivity across the nation.

2.1 Theoretical Foundations: Service Quality and Customer Satisfaction

The concepts of service quality and customer satisfaction are foundational in marketing, consumer behavior, and service management research. Service quality is often regarded as the customer's overall judgment of the excellence of a service, while satisfaction reflects the consumer's emotional response to the service experience.

Parasuraman, Zeithaml, and Berry's (1985) [11] SERVQUAL model has been particularly influential in shaping academic and managerial thinking about service quality. The model conceptualizes service quality through five key dimensions—reliability, responsiveness, assurance, empathy, and tangibles.

These dimensions have been widely applied across industries, including hospitality, banking, health care, and telecommunications, to assess gaps between customer expectations and perceived service delivery [12, 13].

Customer satisfaction extends beyond immediate perceptions of service encounters and has been linked to long-term organizational outcomes such as loyalty, retention, and profitability. The work of Anderson, Fornell, and Lehmann (1994) [14] and Fornell (1992) [15] demonstrated that high levels of satisfaction contribute directly to improved market share and financial performance.

Similarly, the Service Profit Chain framework Heskett & Sasser (2010) [16] posits that internal service quality and employee satisfaction drive superior external service delivery, which in turn enhances customer satisfaction, loyalty, and firm profitability.

Within the telecommunications sector, customer satisfaction is particularly sensitive to technical reliability, network availability, perceived fairness in pricing, and the efficiency of complaint handling mechanisms [17, 18).

Building on these perspectives, scholars have emphasized that satisfaction alone is insufficient unless it translates into behavioral loyalty and advocacy. Theories of customer loyalty suggest that repeated positive experiences foster trust and reduce switching tendencies, even in competitive markets [19, 20].

This is highly relevant to telecommunications, where consumers often face multiple operator choices. Studies such as Eshghi, Haughton, and Topi (2007) [21] underscore that determinants of loyalty in wireless telecommunications include not only technical service quality but also brand image, switching costs, and the perceived value of loyalty programs.

Together, these insights suggest that operators must view service quality and satisfaction as interconnected constructs that influence broader loyalty dynamics.

For Nigerian telecommunications, the theoretical frameworks of service quality and customer satisfaction provide a critical lens for analyzing persistent industry challenges. Despite regulatory benchmarks and infrastructure investments, operators face ongoing difficulties in meeting customer expectations [4, 8].

Integrating the SERVQUAL dimensions with loyalty and profitability theories allows researchers and practitioners to better understand why poor network performance, billing irregularities, and weak complaint resolution have disproportionately negative effects on satisfaction.

It also underscores why investments in both technical performance optimization and relationship management strategies are essential for retaining customers in a highly competitive and saturated market.

Thus, the theoretical foundations not only explain the link between service delivery and satisfaction but also highlight the pathways through which improved quality can foster sustainable competitive advantage in Nigeria's telecom industry [19, 20].

2.2 Quality of Service in Nigerian Telecommunications

Nigeria's telecommunications industry has expanded rapidly, with mobile penetration exceeding 100% by 2022 [4]. However, persistent QoS challenges limit customer satisfaction. Early studies by Adegoke, Babalola, & Balogun, 2008 [22] reported widespread issues of call drops, poor signal strength, and congestion. Subsequent research confirmed that MNOs consistently fall short of NCC benchmarks [7, 23].

Customer-focused studies show mixed levels of satisfaction. Alabar, Ode, and Gbande (2017) [3] found that reliability and empathy were the strongest drivers of satisfaction, while billing irregularities remained a key source of dissatisfaction.

Recent works also highlight the relationship between QoS and loyalty in Nigeria. Momodu & Akpomu (2014) demonstrated that reliability and responsiveness strongly predict customer loyalty in mobile telephony. Similarly, Aninyie (2012) [24] and Popoola, Megbowon, and Adeloye (2009) [25] provided evidence that CSSR and CDR are crucial determinants of perceived service quality.

2.3 Global Perspectives on Telecommunications QoS

Empirical studies on quality of service (QoS) in telecommunications have emphasized the importance of technical performance indicators as benchmarks for network reliability and customer satisfaction.

In Nigeria, Adegoke and Babalola (2011) [26] evaluated GSM systems and found widespread non-compliance with NCC benchmarks, particularly regarding call drop rates and call setup success. Similarly, Popoola, Megbowon, and Adeloye (2009) [25] highlighted deficiencies in GSM performance, stressing that persistent call failures and congestion were systemic across multiple operators.

Alabi, Sagir, Fatai, and Alabi (2017) [23] confirmed these trends in Abuja, reporting that subscribers frequently experienced billing errors and inconsistent service quality, which exacerbated customer dissatisfaction. These studies collectively underscore the gap between regulatory expectations and actual operator performance.

Beyond Nigeria, international studies provide useful comparative insights into QoS challenges. Kadioglu, Dalveren, and Kara (2015) [27], for instance, assessed network performance in Turkey and found that despite advanced infrastructure, operators still struggled to meet QoS benchmarks consistently.

Carlos, Otero, Luis, and Scott (2010) [28] investigated user-perceived QoS in mobile devices and concluded that network performance often varied by context, with urban congestion producing more dissatisfaction than rural coverage gaps. Such findings demonstrate that QoS challenges are not unique to Nigeria but rather reflect global struggles in balancing infrastructure growth with sustainable service delivery.

A second strand of empirical research has focused on the link between QoS and customer satisfaction. Anderson and Fornell (1994) [29] and Zeithaml, Berry, and Parasuraman (1996) [30] established early evidence that higher service quality is directly correlated with increased satisfaction and loyalty.

In the telecommunications context, Dawit and Adem (2018) [31] examined Ethiopian private banks but drew parallels to telecoms, showing that reliability and responsiveness were the strongest predictors of satisfaction. Alabar, Ode, and Gbande (2017) [3] demonstrated similar findings for Nigerian mobile telephony, where customer satisfaction was driven by call clarity, fair billing, and efficient customer service.

These results confirm that technical indicators alone do not explain satisfaction, and that customer-facing processes such as complaint resolution must be considered.

Recent studies also emphasize the role of emerging technologies in addressing QoS challenges. For instance, machine learning and predictive analytics have been increasingly applied to optimize network performance, anticipate congestion, and prevent call drops [32].

In Nigeria, however, limited operator transparency and weak enforcement mechanisms have slowed adoption of such innovations.

Comparative studies suggest that operators in developed markets are better positioned to integrate QoS optimization with customer experience management, whereas Nigerian providers often adopt reactive strategies that fail to prevent dissatisfaction [33, 34).

This gap reinforces the need for integrated approaches that combine technical performance monitoring with proactive complaint resolution and customer relationship management strategies.

2.4 Identified Gaps and Contribution of This Study

Although a considerable body of research has examined telecommunications service quality in Nigeria and globally, significant gaps remain in both scope and methodology. Most Nigerian studies, such as those by Adegoke and Babalola (2011) [26] and Alabi et al.

(2017) [23], concentrate on technical performance indicators like call setup rates, dropped calls, and network congestion. While these metrics are critical, they provide only a partial picture of customer experience. On the other hand, studies that emphasize customer perception focus on satisfaction and loyalty without adequately linking them to regulatory benchmarks or operator compliance data [3].

This separation between technical and perceptual dimensions creates a fragmented understanding of service quality, leaving unanswered questions about how optimizing measurable performance metrics translates into improved customer satisfaction in practice.

Furthermore, there is a shortage of comparative and integrative analyses that combine operator performance data with consumer complaint records. Existing research rarely incorporates secondary datasets such as NCC reports alongside customer protection agency complaints, thereby overlooking the critical intersection between network reliability and service management.

In addition, most studies in Nigeria rely on relatively small sample sizes or localized case studies, which limit generalizability.

Finally, the growing global trend of applying predictive analytics and machine learning to monitor QoS and anticipate churn has not been sufficiently explored in the Nigerian context [32].

Addressing these gaps, this study contributes by integrating regulatory QoS benchmarks with large-scale complaint data to evaluate the dual role of technical optimization and customer engagement in shaping satisfaction outcomes.

III. METHODOLOGY

3.1 Research Design

This study adopts a descriptive and exploratory research design that relies exclusively on secondary data to provide both breadth and depth of analysis. The descriptive dimension enables systematic assessment of how operators perform relative to established benchmarks, while the exploratory approach allows for identifying emerging patterns in customer dissatisfaction and service quality trends.

Data were drawn from multiple sources, including regulatory reports from the Nigerian Communications Commission (NCC), which provide standardized quality of service (QoS) indicators, operator disclosures that highlight self-reported network performance, and consumer complaint records lodged with regulatory and consumer protection agencies.

Integrating these datasets ensures that both technical performance and customer-perceived service quality are captured within a single analytical framework.

The study's focus is therefore twofold: first, to evaluate operator compliance with NCC benchmarks on key indicators such as Call Setup Success Rate (CSSR), Call Drop Rate (CDR), and Handover Success Rate (HOSR); and second, to link these QoS measures to patterns emerging from consumer complaints, thereby offering a holistic perspective on how optimization of performance metrics translates into customer satisfaction outcomes. This approach

not only strengthens the reliability of the findings but also addresses a significant research gap in Nigerian telecommunications studies, where technical and perceptual dimensions of service quality are often treated in isolation.

3.2 Data Sources

The data for this study were obtained from a combination of regulatory, industry, and consumer-level sources to ensure a balanced and comprehensive evaluation of telecommunications service quality in Nigeria.

The primary source was the Nigerian Communications Commission (NCC) Quality of Service (QoS) reports for 2022–2023, which contain standardized technical performance indicators such as CSSR, CDR, HOSR, and traffic congestion rates.

These reports provided the benchmark data against which operator performance was measured. To complement this, industry-level insights from GSMA publications were incorporated, offering regional and global perspectives on network expansion, mobile penetration, and emerging technologies such as LTE and 5G.

Finally, a dataset of 4,327 consumer complaints filed with the Nigerian Consumer Protection Commission (NCPC) and telecom regulatory hotlines during the same period was analyzed to capture the voice of the customer.

These complaints covered issues such as billing irregularities, poor network quality, and inefficient customer service. The integration of regulatory benchmarks, industry perspectives, and consumer feedback allowed for both a technical assessment of operator performance and an interpretive analysis of customer satisfaction trends, ensuring that the study addressed both the supply and demand sides of service quality in the Nigerian telecommunications sector.

3.3 Key Performance Indicators (KPIs)

The evaluation of telecommunications service quality in this study is anchored on four key performance indicators (KPIs) defined by the Nigerian Communications Commission [8] and widely recognized in both academic and industry research. These include;

- the Call Setup Success Rate (CSSR), which measures the percentage of call attempts that successfully connect to the network and reflects the accessibility of services;
- the Call Drop Rate (CDR), which captures the proportion of established calls that are prematurely terminated due to network failures and directly affects reliability;
- the Handover Success Rate (HOSR), which evaluates the seamless transfer of an active call between cells in a mobile network and is particularly critical in high-mobility environments such as urban areas;
- the signal strength, which serves as an indicator of coverage quality and directly influences voice clarity and data speed.

These KPIs were chosen not only because they represent the NCC's regulatory benchmarks but also because they are widely cited in prior empirical studies on service quality in Nigeria and abroad [25, 27].

Together, they provide a robust framework for assessing the technical dimension of service quality and for linking measurable network performance to broader customer satisfaction outcomes. Their inclusion ensures comparability with existing studies while also enabling practical policy implications for operators and regulators.

3.4 Design Specifications and Justification

The design of this study is structured to provide a holistic assessment of service quality in the Nigerian telecommunications sector by integrating both technical performance metrics and customer-centric indicators.

The choice of KPIs—CSSR, CDR, HOSR, and signal strength—was justified by their regulatory relevance and availability in NCC's official reports, ensuring reliability and standardization of measurement.

These metrics were also selected for their direct impact on customer experience: for instance, CSSR reflects the ability of subscribers to initiate

communication, while CDR highlights the frustration of interrupted conversations.

Similarly, HOSR is critical in maintaining continuity for users in motion, and signal strength determines accessibility to both voice and data services. The combination of these indicators allows for a comprehensive evaluation of accessibility, reliability, continuity, and coverage, which are the fundamental pillars of telecommunications service quality.

In addition to technical KPIs, the inclusion of consumer complaint data was intentional to capture the functional and experiential dimensions of service delivery that are often overlooked in purely technical studies.

Complaints about billing irregularities, customer care inefficiencies, and poor redress mechanisms provide valuable insights into service quality beyond infrastructure performance.

This mixed approach was further justified on the grounds of cost-effectiveness and data availability: while real-time proprietary operator datasets remain inaccessible, NCC reports and consumer complaint records are publicly available and provide credible secondary data.

By aligning technical KPIs with consumer feedback, the research design strengthens its explanatory power, ensuring that findings reflect not only regulatory compliance but also the lived realities of Nigerian subscribers. This dual focus enhances the validity of the study and positions it to make both academic and policy-relevant contributions.

3.5 Tools and Computing Environment

Data analysis in this study was conducted using a combination of Microsoft Excel 365, SPSS version 26, and NVivo 14, chosen for their complementary strengths in handling quantitative and qualitative data. Microsoft Excel was employed for the computation of key performance indicators (CSSR, CDR, HOSR, and signal strength), construction of summary tables, and generation of charts to visualize operator performance trends.

SPSS was used to conduct more advanced statistical tests, including descriptive statistics, correlation analysis, and ANOVA, which enabled comparisons of operator performance against NCC benchmarks and across different time periods.

This ensured both accuracy in numerical computation and robustness in inferential analysis. NVivo was applied to the coding and thematic analysis of consumer complaints, which were categorized into billing, network quality, and customer service issues.

The choice of NVivo was justified by its ability to manage large textual datasets and identify recurring themes, thereby providing insights into customer perceptions that complement the technical performance indicators.

The computing environment consisted of a Windows 11 operating system, Intel Core i7 processor, and 16 GB RAM, which provided sufficient capacity to run the analyses efficiently without system lags. Together, these tools ensured methodological rigor and allowed the study to integrate technical performance metrics with consumer experience data in a systematic and replicable manner.

3.6 Data Analysis Procedure

The data analysis procedure for this study followed a systematic, multi-stage process designed to capture both the technical and perceptual dimensions of service quality. First, operator performance data were extracted from NCC Quality of Service (QoS) reports for 2022–2023, and key performance indicators (CSSR, CDR, HOSR, and signal strength) were computed using Microsoft Excel to ensure consistency with NCC-defined formulas.

These KPIs were then compared against NCC benchmarks to assess compliance and identify gaps in operator performance. Second, statistical tests were conducted in SPSS, including descriptive statistics to profile each operator's performance, correlation analysis to examine relationships between KPIs, and ANOVA tests to compare operator results across multiple quarters.

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Third, consumer complaint records (n = 4,327) were imported into NVivo and coded into categories such as billing issues, network quality problems, and customer service concerns. Frequency counts and thematic analysis were performed to uncover dominant patterns in consumer dissatisfaction.

Fourth, the results from complaint analysis were integrated with KPI findings through regression models, which tested the extent to which optimization of technical indicators influenced customer satisfaction outcomes.

Finally, operator performance was benchmarked against previous Nigerian studies and selected international cases, enabling comparative discussion and contextualization of findings. This structured approach ensured that the analysis was both rigorous and holistic, bridging the gap between regulatory metrics and consumer experiences.

IV. RESULTS AND DISCUSSION

4.1 Operator Performance against NCC Benchmarks

Table 1 presents the performance of Nigeria's four major mobile network operators—MTN, Airtel, Glo, and 9mobile—against the NCC Quality of Service (QoS) benchmarks for 2022–2023. For clarity, Operator A refers to MTN, Operator B to Airtel, Operator C to Glo, and Operator D to 9mobile.

The benchmarks, as defined by NCC, are a minimum CSSR of 98%, a maximum CDR of 2%, a minimum HOSR of 95%, and a maximum TCH congestion rate of 2%.

Table 1: Operator QoS performance vs. NCC benchmarks (2022–2023)

KPI	NCC Benchmark	MTN (A)	Airtel (B)	Glo (C)	9mobile (D)	Compliance (%)
CSSR (%)	≥ 98	95.4	97.8	92.1	96.5	50
CDR (%)	≤ 2	3.2	2.4	4.1	2.9	25
HOSR (%)	≥ 95	90.7	94.2	89.3	92.5	0
TCHCR (%)	≤ 2	2.5	1.9	3.1	2.3	25

The table above graphically illustrates operator performance compared to NCC's thresholds. The results reveal significant gaps between regulatory expectations and actual operator performance.

MTN and Airtel consistently outperformed Glo and 9mobile on CSSR and HOSR, indicating better accessibility and handover stability, particularly in urban centers where these operators have invested heavily in LTE infrastructure. Airtel came closest to meeting the CSSR benchmark at 97.8%, but still fell slightly below the 98% requirement, while MTN remained steady at 95.4%. Glo recorded the weakest performance at 92.1%, reflecting persistent network congestion and call setup failures, while 9mobile showed moderate performance at 96.5%.

Call Drop Rate (CDR) presented the most critical area of non-compliance, with none of the operators meeting the ≤ 2% benchmark. Glo performed worst with 4.1%, indicating frequent service disruptions, while Airtel fared slightly better at 2.4% but still failed to meet regulatory standards.

MTN and 9mobile also exceeded the threshold, with rates of 3.2% and 2.9% respectively. Handover Success Rate (HOSR) was another area of weakness, as all four operators fell short of the 95% benchmark, with Glo again lagging significantly at 89.3%. These

findings confirm earlier observations in the literature that Nigerian operators consistently underperform in network continuity and reliability [26, 7].

Overall, compliance with NCC standards was poor: only 50% of operators met the CSSR benchmark, 25% met the TCH congestion requirement, and none satisfied the HOSR or CDR benchmarks.

These results highlight systemic deficiencies in network performance despite years of infrastructure investment. They also demonstrate why customer dissatisfaction remains high, as frequent call drops, setup failures, and handover interruptions directly translate into poor user experiences.

The persistence of these gaps suggests that operators' efforts at performance optimization have been insufficient to meet regulatory expectations or to deliver reliable services to consumers.

4.2 Customer Complaint Analysis

A total of 4,327 consumer complaints were analyzed, covering billing, network quality, and customer service issues. Table 2 provides the distribution of these complaints.

Table 2: Distribution of customer complaints (2023)

	Number of Complaints	Percentage (%)
Billing issues	1,742	40.3
Network quality	1,528	35.3
Customer service	1,057	24.4

The analysis reveals that billing issues accounted for the largest share of complaints (40.3%). These included unauthorized deductions, inaccurate billing for voice and data services, and difficulties obtaining refunds.

This finding is consistent with Alabar, Ode, and Gbande (2017) [3] who identified billing irregularities as a major determinant of customer dissatisfaction in Nigerian telecommunications. Billing complaints also highlight a gap between technical service delivery and functional quality [36], as subscribers often tolerate occasional network disruptions but perceive unfair billing as a violation of trust.

Network quality-related complaints represented 35.3% of the dataset and were primarily associated with dropped calls, slow internet speeds, and poor indoor coverage.

This reflects the persistent underperformance of operators in meeting NCC benchmarks for CSSR, CDR, and HOSR, as shown in Table 1. The close alignment between KPI shortfalls and complaint trends validates the argument that technical optimization is directly linked to customer experiences [30]. Consumers expect reliability and continuity, and when operators fail to deliver on these dimensions, dissatisfaction escalates.

Customer service issues, accounting for 24.4% of complaints, centered on delayed responses, unresolved queries, and unprofessional handling of customer concerns.

This highlights the critical role of responsiveness and empathy, dimensions emphasized in the SERVQUAL model [11]. Poor service interactions not only intensify dissatisfaction but also reduce loyalty, as customers who perceive neglect are more likely to switch providers [37].

Taken together, the complaint analysis underscores that while technical metrics such as CSSR and CDR shape perceptions of network quality, billing fairness and effective complaint resolution are equally important for sustaining satisfaction.

This reinforces the Service Profit Chain theory [16], which posits that customer satisfaction is the product of both operational performance and quality of service encounters. Nigerian operators, therefore, cannot rely solely on infrastructure upgrades; they must also strengthen customer-facing processes to address grievances promptly and transparently.

4.3 Linking QoS Optimization and Customer Satisfaction

To examine the relationship between network performance and customer satisfaction, regression analysis was conducted using CSSR, CDR, HOSR, and signal strength as independent variables, and customer satisfaction scores (proxied by complaint resolution outcomes) as the dependent variable.

The results revealed that CSSR and CDR were the strongest predictors of satisfaction, with regression coefficients of $\beta = 0.48$ ($p < 0.01$) and $\beta = -0.39$ ($p < 0.05$), respectively.

This indicates that an improvement in call setup success significantly enhances satisfaction, while a reduction in call drops correspondingly reduces dissatisfaction. These findings confirm that connection reliability and stability remain the most critical dimensions of customer experience in Nigerian telecommunications.

The analysis further showed weaker but positive associations between satisfaction and HOSR ($\beta = 0.21$, $p < 0.10$) and signal strength ($\beta = 0.19$, $p < 0.10$). Although these factors were statistically less significant than CSSR and CDR, they still contributed meaningfully to customer perceptions, particularly in high-mobility contexts where seamless handovers are essential.

This aligns with earlier research by Adegoke and Babalola (2011) [26], who emphasized that interruptions during calls strongly erode customer trust in operator reliability.

Importantly, the regression analysis highlighted that optimizing technical KPIs alone does not fully explain customer satisfaction outcomes. While network accessibility and continuity are essential, the prevalence of billing-related complaints and customer service issues (as shown in Table 2) demonstrates that functional quality plays an equally important role.

This reinforces the theoretical position of Crosby (1996) [38] and Zeithaml, Berry, and Parasuraman (1996) [30], who argue that satisfaction arises from a combination of technical performance and service interaction quality. In practice, this means that even if an operator improves its CSSR and reduces call drops, unresolved billing disputes or poor complaint handling can still drive dissatisfaction and customer churn.

Overall, the regression results provide strong empirical evidence that Nigerian mobile network operators must adopt a dual optimization strategy—strengthening both network reliability and customer-facing processes.

This integrated approach would not only improve compliance with NCC benchmarks but also address the broader drivers of satisfaction and loyalty in a competitive telecom market.

4.4 Comparison with Existing Studies

Table 3 presents a comparative analysis between the findings of this study and selected Nigerian and international research on telecommunications service quality.

Table 3: Comparison with previous studies

Study	Context	Findings	Alignment with This Study
Adegoke & Babalola (2011)	Nigeria (GSM)	Poor QoS compliance in urban areas	Confirmed
Alabi et al. (2017)	Abuja, Nigeria	Billing & network quality key complaints	Confirmed

Kadioglu et al. (2015)	Turkey	Operators failed to meet QoS benchmarks	Confirmed
Carlos et al. (2010)	International	User-perceived QoS varies with usage	Partially aligned

The results of this study strongly confirm the earlier conclusions of Adegoke and Babalola (2011), who reported widespread non-compliance with NCC's QoS benchmarks, particularly in urban centers where congestion was severe.

The finding that all four major Nigerian operators consistently failed to meet requirements for Call Drop Rate (CDR) and Handover Success Rate (HOSR) demonstrates that, more than a decade later, the systemic QoS deficiencies identified in earlier studies remain unresolved. This suggests that regulatory enforcement and operator investment have not been sufficient to close the performance gap.

The study also aligns with Alabi et al. (2017) [23], who showed that billing problems and poor network quality were the primary drivers of consumer dissatisfaction in Abuja.

The dominance of billing-related complaints in this study (40.3%) underscores the persistence of this issue nationwide, confirming that technical improvements alone cannot guarantee satisfaction if billing transparency and complaint resolution mechanisms remain weak. These findings highlight the importance of incorporating functional service quality into QoS assessments.

International comparisons provide additional insights. Kadioglu et al. (2015) [27] reported that Turkish operators also struggled to meet regulatory QoS benchmarks despite advanced infrastructure investments, which mirrors the Nigerian case.

This similarity demonstrates that QoS compliance is a global challenge, not limited to developing economies, although the severity of billing complaints appears to be uniquely Nigerian.

Dahunsi, and Kolawole (2015) [39], on the other hand, emphasized that user-perceived QoS varies depending on the context of service usage. While this study partially confirms that customer perceptions of network performance differ by location and use-case, the Nigerian evidence suggests that systemic underperformance, rather than situational variation, is the dominant factor shaping dissatisfaction.

Taken together, these comparisons reinforce the validity of this study's findings while situating them within broader empirical debates. They also reveal that Nigeria's telecom industry suffers not only from the universal technical challenges of meeting QoS standards but also from context-specific issues such as billing irregularities and ineffective customer service systems [40].

This dual challenge underscores the urgent need for both infrastructure optimization and customer relationship management reforms if operators are to achieve sustainable improvements in satisfaction and loyalty.

4.5 Discussion of Implications

The findings of this study carry important implications for regulators, operators, and researchers seeking to address persistent service quality challenges in Nigeria's telecommunications industry.

For regulators, particularly the Nigerian Communications Commission (NCC), the evidence highlights the urgent need for stricter enforcement of existing QoS benchmarks. Despite setting clear targets for CSSR, CDR, HOSR, and traffic congestion, operators continue to fall short of compliance.

Regulatory responses have historically included fines and sanctions, but the persistence of poor performance suggests that penalties alone are insufficient. Instead, NCC may need to adopt a more proactive approach by mandating transparent reporting systems, conducting independent third-party QoS audits, and linking spectrum allocations or

license renewals to consistent performance improvements [41].

For operators, the results underscore that network reliability and complaint resolution are dual pillars of customer satisfaction. While MTN and Airtel performed relatively better than Glo and 9mobile in CSSR and HOSR, none of the operator's met benchmarks for call drop rates, which remain a critical driver of dissatisfaction. Furthermore, billing issues emerged as the single most significant source of complaints, surpassing even technical failures.

This finding suggests that investments in infrastructure alone will not secure long-term customer loyalty unless accompanied by reforms in billing transparency and customer service responsiveness. Operators therefore need to implement robust customer relationship management (CRM) systems, train frontline staff in problem resolution, and deploy real-time billing monitoring to prevent unauthorized deductions [42, 43]..

The implications also extend to the broader policy and business environment. Persistent QoS failures not only frustrate consumers but also hinder digital inclusion, e-commerce growth, and financial services adoption that rely on reliable telecommunications infrastructure.

As Nigeria transitions toward 5G networks, the inability to resolve foundational QoS issues raises questions about the readiness of operators to deliver advanced services. Policymakers must therefore balance the push for new technologies with strategies that ensure basic service reliability and fairness for consumers.

Finally, for researchers, this study demonstrates the value of integrating technical QoS metrics with consumer complaint analysis. Traditional studies that focus exclusively on either performance indicators or customer perceptions provide only a partial view. By combining these dimensions, this study shows how technical underperformance and functional inefficiencies jointly influence customer satisfaction.

Future empirical research should build on this approach by incorporating predictive analytics and machine learning to anticipate QoS failures and forecast customer churn. This would not only advance academic understanding but also provide practical tools for regulators and operators seeking to improve the customer experience in Nigeria's dynamic telecom sector.

V. LIMITATIONS, CONCLUSION, AND RECOMMENDATIONS

This study offers important insights into how performance metrics shape customer satisfaction within Nigeria's telecommunications sector; however, several limitations must be acknowledged. The research relied solely on secondary data obtained from NCC Quality of Service reports, GSMA publications, and 4,327 consumer complaints.

Although these sources are reputable, they lack the depth and contextual richness that primary data—such as real-time drive tests, customer surveys, or focus group interviews—could have provided. As a result, critical nuances regarding customer emotions, behavioural responses, and regional variations in satisfaction may not have been fully captured.

The absence of first-hand user experiences limits how precisely the findings can reflect the diversity of Nigeria's vast subscriber base.

Furthermore, the scope and availability of secondary datasets imposed methodological restrictions. The NCC's focus on a narrow set of KPIs—such as CSSR, CDR, HOSR, and traffic congestion—excludes other essential indicators like latency, jitter, and broadband speeds, which are central to modern telecommunications performance.

Similarly, the consumer complaint dataset presents inherent self-selection bias, as only subscribers motivated to lodge complaints are represented. This overemphasis on dissatisfied users may skew the interpretation of network performance trends and customer experience.

The lack of access to proprietary operator datasets, such as call detail records or geo-analytics, further constrained the analysis, limiting the study's ability

to explore causal relationships or perform advanced spatial modeling.

Despite these limitations, the study successfully integrates technical QoS metrics with consumer complaints to present a holistic view of Nigeria's telecommunications challenges.

The findings show that none of the major operators—MTN, Airtel, Glo, and 9mobile—fully complied with NCC standards, especially regarding call drop rate and handover success rate. Airtel and MTN performed relatively better, while Glo consistently underperformed across most metrics.

Importantly, regression analysis highlighted that both CSSR and CDR significantly influence customer satisfaction, reflecting the centrality of accessibility and reliability in shaping user perceptions [44, 45].

However, the prevalence of billing-related complaints, representing over 40% of total grievances, underscores that network reliability alone cannot guarantee satisfaction; functional service failures also play a major role.

Drawing from these findings, several recommendations emerge for regulators, operators, and industry stakeholders.

The NCC should strengthen regulatory enforcement by implementing real-time monitoring systems, increasing transparency in operator performance reporting, and imposing stricter penalties for non-compliance.

Linking QoS performance to license renewals and spectrum allocation would further incentivize consistent adherence to standards [8, 46, 47]. For telecom operators, the study emphasizes a dual strategy: investing in infrastructure upgrades—such as 4G densification and 5G rollout—to enhance technical reliability, while simultaneously reforming billing systems and improving customer service responsiveness.

Integrating advanced CRM systems and analytics-driven complaint management will also be essential for reducing churn and rebuilding customer trust.

Finally, future research should incorporate robust primary data collection to broaden the validity of findings. Large-scale customer surveys, sentiment analysis, and real-time network measurements would provide a richer understanding of user experiences.

Researchers can also explore predictive analytics and machine learning models to forecast QoS deterioration or potential customer churn dynamically [48, 49] Comparative studies across African and emerging markets could further contextualize Nigeria's challenges and highlight transferable policy or operational solutions.

Addressing these future research gaps will strengthen evidence-based policymaking and support Nigeria's broader digital transformation goals by ensuring that telecommunications infrastructure keeps pace with rising consumer expectations and the demands of a rapidly digitizing economy [50].

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