Customer Sentiment on Telecommunication Quality of Service Delivery in Ghana

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ABSTRACT

Aim/Purpose

This study investigates customer sentiment toward telecom Quality of Service Delivery (QoSD) in Ghana by integrating *dual sentiment*, that is, an expressed emotional sentiment from customer narratives and experienced service sentiment derived from SERVQUAL ratingsinto a unified service quality evaluation framework.

Background

Although SERVQUAL-based research consistently links service quality dimensions to customer satisfaction, far less is known about how emotional expressions interact with cognitive service evaluations in developing markets. This gap limits understanding of how users interpret service failures and form satisfaction judgments in resource-constrained telecom environments.

Methodology

A nationwide survey of 536 mobile users was analyzed using a hybrid analytical approach: (1) natural language processing (NLP) sentiment scoring of open-ended responses, and (2) construction of a Service Sentiment Index (SSI) based on standardized SERVQUAL dimension scores. Mediation analysis using Hayes' PROCESS tested whether experienced sentiment serves as a psychological pathway linking reliability to overall satisfaction.

Contribution

The study introduces and empirically validates a **dual-sentiment framework** for telecom QoSD assessment, demonstrating significant divergence between customers' expressed emotional sentiment and their experienced service sentiment. It extends the SERVQUAL model by incorporating affective evaluation processes and provides empirical evidence that sentiment partially mediates the reliability–satisfaction relationship.

Findings

Expressed sentiment was predominantly negative (56.5%), whereas SSI reflected more moderate evaluations. Reliability, assurance, and empathy emerged as key predictors of both sentiment and satisfaction. Mediation results confirmed that experienced sentiment explains a substantial portion of the total effect of reliability on satisfaction, supporting a dual cognitive–affective interpretation of QoSD.

Recommendations for Practitioners

Telecom providers should prioritize network reliability, transparent communication, and empathetic customer engagement to address emotional dissatisfaction. The presence of strong negative expressed sentimenteven among customers reporting moderate satisfactionsignals potential reputational and churn risks requiring proactive management.

Recommendations for Researchers

Researchers should integrate text analytics with psychometric models in service quality studies and further examine sentiment as a mediator across diverse service industries and cultural settings.

Impact on Society

Understanding sentiment divergence enhances the design of customer-centric QoS interventions, strengthens regulatory oversight, and supports the development of more responsive telecom service policies in emerging markets.

Future Research

Longitudinal studies should explore sentiment trajectories over time, while cross-market comparative research should validate the generalizability of the dual-sentiment framework across other developing and developed economies.

Keywords: Customer Sentiment; Dual Sentiment; QoSD; SERVQUAL; Mediation; NLP Sentiment; Telecommunications; Ghana.

INTRODUCTION

Telecommunication services constitute a critical enabler of socioeconomic development in Ghana, supporting commerce, education, financial inclusion, emergency communication, and everyday interpersonal interaction. Over the past decade, the sector has experienced rapid expansion driven by increased mobile penetration, widespread adoption of mobile money, and continuous investment in digital infrastructure. These advances have heightened consumer expectations, placing Quality of Service Delivery (QoSD) at the center of competitive differentiation and regulatory scrutiny. As mobile users increasingly depend on data-driven applications, reliable connectivity, transparent pricing, and efficient customer support have become essential components of the consumer experience.

Quality of Service Delivery in telecommunications is traditionally conceptualized through models such as SERVQUAL, which emphasize reliability, responsiveness, assurance, empathy, and tangibles as determinants of customer satisfaction (Parasuraman et al., 1988). Numerous studies have affirmed the relevance of these dimensions in the African telecom landscape, particularly the centrality of network reliability and customer support in shaping satisfaction and loyalty. However, despite considerable investment and regulatory interventions, Ghanaian mobile users continue to report persistent service quality concerns, including network instability, high data costs, inconsistent coverage, and limited responsiveness to complaints. These challenges contribute to fluctuating customer satisfaction levels and increasing public pressure on service providers and regulators to address systemic QoSD issues.

Although the link between service quality and customer satisfaction in telecommunications is well documented, an important theoretical and empirical gap remains. Prior research has focused predominantly on cognitive evaluations which involved how customers rate service quality dimensions while largely overlooking affective sentiment, i.e., how customers *feel* when describing their service experiences in their own words. This omission is notable because service quality failures often trigger emotional responses (frustration, dissatisfaction, disappointment) that may not be fully captured through structured Likert-scale ratings. Emerging research in customer analytics indicates that customers may express negative emotions even when their numeric evaluations appear neutral or moderately positive, a phenomenon known as sentiment divergence.

Ghana's telecommunication sector offers an ideal context for advancing this line of inquiry. Mobile customers frequently articulate dissatisfaction on social media, in call-center interactions, and in informal conversations, yet survey ratings often reveal moderate or stable satisfaction scores. This mismatch suggests that traditional QoSD assessment models may underestimate or misinterpret the emotional dimensions of customer experience.

Understanding this divergence is essential for improving service delivery, designing responsive interventions, and strengthening the relationship between service providers and customers.

This study contributes to filling this gap by integrating dual sentiment analysis by combining expressed sentiment extracted from open-ended text responses with experienced sentiment measured through a composite Service Sentiment Index (SSI) derived from SERVQUAL dimensions. This dual approach enables a richer understanding of customer perceptions by capturing both the cognitive and affective elements of QoSD evaluations. Moreover, the study examines whether sentiment functions as a mediating mechanism through which reliability influences overall satisfaction, thereby extending existing service quality frameworks with a theoretically grounded affective pathway.

Using a nationwide dataset of 536 mobile users, this study provides empirical evidence on the interplay between service quality dimensions, sentiment expression, demographic characteristics, and overall satisfaction in the Ghanaian telecommunication sector. By adopting an integrated quantitative–textual analytical strategy, the study offers both theoretical insight and practical recommendations for service providers and regulators. The introduction of the dual-sentiment framework also responds directly to calls for more advanced methodological approaches in QoS research, particularly within African and emerging market contexts where service experiences can be emotionally charged.

Overall, this study enhances current understanding of customer sentiment in telecommunications by revealing how cognitive evaluations and emotional expressions interact to shape satisfaction and recommendation intentions. The findings underline the need for more holistic QoSD assessments that consider not only what customers say in ratings but also what they articulate in their own words.

LITERATURE REVIEW

Quality of Service Delivery in Telecommunications

Quality of Service Delivery (QoSD) is a central construct in telecommunications research, reflecting the extent to which network operators deliver reliable, responsive, and satisfactory services to customers. As mobile communication has become the primary medium for social and economic activity in developing economies, QoSD has emerged as a critical differentiator of customer satisfaction and competitive advantage (Ladhari, 2009). In regions such as sub-Saharan Africa, the rapid expansion of mobile networks has amplified expectations for stable connectivity, transparent pricing, and efficient customer care, placing pressure on operators to improve service standards.

The SERVQUAL framework (Parasuraman, Zeithaml & Berry, 1988) remains the dominant theoretical model for evaluating service quality across industries, including telecommunications. The framework identifies five dimensions namely reliability, responsiveness, assurance, empathy, and tangibles as key drivers of service quality perceptions. Research in telecommunications contexts consistently highlights reliability as the most influential dimension, given the centrality of network stability, data performance, and call quality to customer experience (Agyapong, 2011; Kyei & Bayoh, 2017). Responsiveness and assurance also play substantial roles as customers depend on operators to provide timely support and inspire confidence in technical and security issues. Tangibles, though part of the original SERVQUAL model, have shown declining relevance in digital-first service environments where physical facilities and personnel visibility are minimal.

Although the SERVQUAL model is widely adopted, scholars increasingly recognize its limitations in capturing contemporary customer experiencesparticularly emotional, digital, and contextual nuances. Studies have called for adaptations of SERVQUAL to incorporate digital service features such as mobile app responsiveness, data performance, and perceived fairness of pricing, especially in emerging markets (Hult et al., 2020). These concerns are particularly salient in countries like Ghana, where network congestion, fluctuating internet speeds, and customer service gaps frequently shape user perceptions.

QoSD in the African and Ghanaian Telecommunications Context

The African telecommunications sector has undergone transformative growth, driven by liberalization, increased mobile penetration, and the rise of mobile money services (Aker & Mbiti, 2010). Despite these advancements, service quality challenges persist, including inconsistent coverage, infrastructure limitations, and high data costs. These issues often lead to user dissatisfaction and contribute to consumer advocacy and complaints on social and digital platforms.

In Ghana, QoSD remains a central regulatory priority. Reports from the regulatory body (NCA) frequently identify gaps in network reliability, data performance, and customer support. Empirical studies on the Ghanaian market such as a survey of MTN Ghana subscribers highlight that perceived service quality and relationship quality significantly influence customer satisfaction, underscoring the importance of service delivery and trust in shaping user evaluations (Oduro, Boachie-Mensah & Agyapong, 2018). Yet, these studies rely predominantly on structured surveys and traditional service-quality frameworks, offering limited insight into customers' affective responses or how emotional sentiment intersects with cognitive evaluations.

The literature has not sufficiently examined how Ghanaian telecom users **express** their dissatisfaction or satisfaction, especially through open-ended comments that may reflect frustration, disappointment, or anger more vividly than Likert ratings. This omission creates a gap: existing models describe how customers rate QoS, but not how they emotionally articulate QoS experiences.

Sentiment in Service Quality Research

Sentiment, broadly defined as the emotional tone underlying customer expressions, is increasingly recognized as central to understanding service experiences. Research in marketing and consumer behavior shows that emotional responses such as anger, frustration, satisfaction, delight play a direct role in shaping loyalty, trust, and customer advocacy (Homburg et al., 2015). Advances in natural language processing (NLP) have enabled researchers to extract sentiment from unstructured customer feedback, social media, and product reviews, offering richer insight into authentic customer emotions (Cambria et al., 2013).

However, sentiment has not been adequately integrated into telecom QoSD research, particularly in African contexts. Most existing studies treat sentiment as synonymous with satisfaction, relying solely on numerical ratings. This conflation ignores the well documented distinction between cognitive evaluations (structured ratings) and affective expression (open-ended emotional statements). Research increasingly suggests that customers may verbalize dissatisfaction even when providing moderate numeric ratings, a phenomenon known as sentiment divergence.

Scholars such as De Keyser et al. (2020) argue for hybrid models that combine attitudinal scales with emotional analysis to fully capture modern service experiences. This aligns with the emerging need to integrate sentiment into QoSD frameworks, especially in markets where service shortcomings evoke strong emotional reactions.

Dual Sentiment: Integrating Cognitive and Affective Evaluations

The concept of dual sentiment which involves the coexistence of experienced sentiment measured through structured scales and expressed sentiment captured from open text remains underexplored in telecom research. While sentiment analysis tools can classify open-ended comments into positive, neutral, and negative tones, few studies combine these classifications with traditional SERVQUAL-derived scores to provide a fuller picture of customer perceptions.

The theoretical value of dual sentiment lies in its ability to reveal alignment or misalignment between what customers say and what they rate. Such divergence has significant implications:

1. It may explain why customers churn despite reporting moderate satisfaction.

2. It may indicate emotional dissatisfaction not captured by structured surveys.

3. It may uncover latent service issues masked by general rating averages.

Despite its potential, no known study in the Ghanaian telecom context has integrated text-based sentiment with SERVQUAL-derived indices in a unified framework.

Sentiment as a Mediating Psychological Mechanism

The literature on service quality highlights the mediating role of psychological constructs such as trust, perceived value, and satisfaction. However, sentiment, particularly affective sentiment has rarely been examined as a mediator. Theoretically, service reliability should influence customer sentiment, which then shapes overall satisfaction. When service is reliable, customers are more likely to express positive sentiment; when service fails, sentiment becomes negative, subsequently reducing satisfaction.

Yet, this proposed mechanism has not been empirically examined in the Ghanaian telecom sector. Integrating sentiment as a mediator introduces an affective pathway into SERVQUAL, enriching the model and aligning it with contemporary emotional-cognition theories in customer experience research.

Identified Gaps and Study Justification

Based on the review, four major gaps remain in the literature:

1. Lack of integration of emotional sentiment into telecom QoSD research, despite strong evidence that customers express dissatisfaction emotionally.

2. Absence of dual-sentiment frameworks combining text-based expression and scale-based experience in African telecommunications studies.

3. Limited understanding of sentiment divergence, is the mismatch between expressed dissatisfaction and moderate numeric ratings.

4. Lack of empirical testing of sentiment as a mediator, leaving theoretical gaps in explaining how service quality dimensions influence satisfaction.

5. This study addresses these gaps by:

6. Introducing a dual-sentiment analytic framework integrating NLP sentiment scoring with a Service Sentiment Index.

7. Testing sentiment as a mediator between reliability and satisfaction.

8. Providing new empirical evidence on sentiment divergence in the Ghanaian telecom sector.

9. Extending SERVQUAL by embedding emotional mechanisms into its traditionally cognitive structure.

METHODOLOGY

Research Design

The study employed a cross-sectional quantitative research design supplemented with text-based sentiment analysis. This approach was chosen to capture both the cognitive evaluations of service quality through structured Likert-scale items and the affective expressions of customers through open-ended responses. The integration of numeric and textual data supports the dual-sentiment framework and enables modeling of sentiment as a mediating variable between service quality and satisfaction.

Population, Sampling and Sample Size

The target population comprises mobile telecommunication users in Ghana who are 18 years or older. Ghana's mobile market is characterized by high penetration and multiple competing operators, with users distributed across all regions and across urban, peri-urban, and rural areas. Given the absence of a national sampling frame of individual subscribers and the practical difficulty of drawing a true probability sample, a non-probability sampling strategy was employed. Questionnaires were distributed to subscribers who were accessible to the researchers in different settings and who consented to participate. This approach combines convenience and voluntary response sampling, a practice commonly adopted in exploratory QoSD and service-quality studies where the population is large and geographically dispersed.

The minimum required sample size was estimated using Cochran's formula for large populations at a 95% confidence level and 5% margin of error, assuming maximum variability ($p = 0.5$). This yielded a minimum of 384 respondents. In practice, 536 valid responses were collected across the 16 regions of Ghana, thereby exceeding the minimum requirement and providing sufficient power for factor analysis, regression modelling, and mediation testing.

Instrumentation and Measures

Data were collected using a structured questionnaire comprising both closed-ended and open-ended items.

Service Quality Dimensions

The five SERVQUAL dimensions namely reliability, responsiveness, assurance, empathy, and tangibles were measured using multiple Likert-scale items (1 = very low to 5 = very high). These items have been validated in prior telecommunications research and reflect core aspects of QoSD.

Customer Satisfaction and Recommendation

Overall satisfaction and likelihood to recommend were measured using 5-point Likert items frequently used in telecom satisfaction research.

Demographic Characteristics

Age, gender, education, and geographic region were included to assess demographic effects on satisfaction and sentiment.

Open-Ended Sentiment Question

To capture affective sentiment, respondents were asked:

"What specific improvements would you prioritize to enhance your satisfaction?"

This item generated 536 textual responses, used to derive expressed sentiment.

Data Collection Procedures

The survey was administered through a hybrid approach consisting of:

1. Online distribution (email, social media, messaging platforms)
2. Offline, paper-based administration in selected communities
3. Telephone-assisted surveys for rural respondents with limited digital access

This ensured broader coverage and inclusion of otherwise underrepresented groups.

All responses were anonymized to maintain confidentiality.

Data Preparation and Cleaning

Data cleaning involved:

1. Verifying completeness of responses

2. Removing invalid or blank entries in open-ended fields

3. Standardizing text (lowercase, punctuation removal, stop-word removal)

4. Recoding categorical variables for analysis

Numeric items were screened for outliers and missing values; missing data accounted for <1% and were handled using listwise deletion.

Dual-Sentiment Framework

The dual-sentiment approach consisted of two complementary components: text-based sentiment analysis and psychometric sentiment measurement.

Text-Based (Expressed) Sentiment Analysis

In parallel with the SSI, expressed sentiment was derived from the open-ended responses using a lexicon-based sentiment analysis tool, the VADER (Valence Aware Dictionary and sEntiment Reasoner) algorithm. VADER is particularly appropriate for short, informal texts of the kind produced in surveys and social media and has been widely used in applied sentiment research.

Each cleaned response was submitted to the sentiment engine, which returned four values: a positive score, a negative score, a neutral score, and a compound score ranging from -1 (maximally negative) to $+1$ (maximally positive). The compound score was used as the principal summary measure of expressed sentiment. Following the widely adopted conventions for VADER, compound scores greater than or equal to $+0.05$ were classified as positive, scores less than or equal to -0.05 as negative, and scores in between as neutral. This yielded three expressed sentiment classes namely positive, neutral, and negative for each respondent.

Beyond numeric sentiment scores, the textual responses were also examined qualitatively to identify recurring themes. Responses were grouped by sentiment class, and within each class, thematic coding was used to organize comments into categories such as network reliability, data pricing, customer service, coverage gaps, and security or fraud concerns. This thematic layer complements the numeric sentiment measures and helps interpret what the positive or negative sentiment refers to in substantive terms.

Steps:

1. **Preprocessing:**

All textual responses were cleaned and standardized.

2. **Polarity Scoring:**

3. Each response was processed through VADER to generate:

1. Positive score

2. Negative score

3. Neutral score

4. Compound score (overall sentiment)

4. **Sentiment Classification:**

5. Based on standard VADER thresholds:

1. Compound ≥ 0.05 → Positive

2. Compound ≤ −0.05 → Negative

3. Otherwise → Neutral

This resulted in three sentiment classes for each respondent.

4. **Thematic Coding:**

Sentiment-labeled responses were analyzed using inductive thematic analysis to identify commonly expressed issues (e.g., network reliability, pricing, coverage).

Psychometric (Experienced) Sentiment: Service Sentiment Index (SSI)

Experienced sentiment was operationalized through a composite index constructed from the SERVQUAL-based items. The underlying idea is that customers' ratings on reliability, responsiveness, assurance, empathy, and tangibles collectively reflect an affective–cognitive evaluation of service; this evaluation can be summarized as a continuous sentiment construct.

To avoid scale and variance distortions and to ensure that each dimension contributed comparably, all items associated with the five service-quality dimensions were first standardized using z-scores. The Service Sentiment Index (SSI) for respondent i was then calculated as the arithmetic mean of the standardized scores across the five dimensions.

Experienced sentiment was derived from the SERVQUAL-based items.

Steps:

1. **Reliability Assessment:**

Internal consistency was evaluated using Cronbach's α. The sentiment-related items achieved α = 0.73.

2. **Standardization:**

All SERVQUAL items were transformed into z-scores to ensure equal weighting.

3. **Composite Index:**

The Service Sentiment Index (SSI) was computed as the mean of the standardized scores:

$$SSI_i = \frac{Z_{Reliability} + Z_{Responsiveness} + Z_{Assurance} + Z_{Empathy} + Z_{Tangibles}}{5}$$

4. **SSI Classification:**

1. Low sentiment: SSI ≤ −0.50

2. Neutral sentiment: −0.49 to +0.49

3. High sentiment: $SSI \geq +0.50$

This index captures the affective–cognitive experience of service quality.

Dual Sentiment Integration

The two sentiment measures namely experienced sentiment (SSI) and expressed sentiment (VADER-based classification) were then integrated into a combined framework. For each respondent, the continuous SSI value and its three-level categorical band were paired with the expressed sentiment class. This produced a 3×3 dual-sentiment matrix with nine possible cells, representing combinations such as "negative expressed sentiment but high SSI" or "positive expressed sentiment and high SSI".

This matrix is used descriptively to examine the degree of alignment or divergence between how customers rate their service experiences and how they verbalize their feelings about those experiences. It allows the study to identify groups of users who, for example, report moderate or high service evaluations but still express negative emotions about particular aspects of service, an important phenomenon for both theory and practice.

Factor Analysis

Exploratory factor analysis (EFA) was conducted to verify the dimensional structure of service quality items. Suitability for EFA was confirmed by:

1. KMO = 0.897 (excellent)

2. Bartlett's Test of Sphericity: $p < .001$

Four factors with eigenvalues > 1 were extracted, explaining 63.48% of the total variance, confirming that service quality constructs align with theoretical expectations.

Mediation Analysis

To extend SERVQUAL and examine the emotional pathway between service quality and satisfaction, a mediation model was tested:

1. Independent variable (X): Reliability

2. Mediator (M): Service Sentiment Index (SSI)

3. Dependent variable (Y): Customer satisfaction

Hayes' PROCESS Macro (Model 4) was applied with 5,000 bootstrap samples and 95% confidence intervals.

Significance was inferred when bootstrap confidence intervals excluded zero.

Ethical Considerations

Participation was voluntary, with informed consent obtained from all respondents. Data were anonymized, and no identifiable information was collected. The study adhered to ethical standards for human-subject research.

RESULTS

Demographic Profile of Respondents

A total of 536 valid responses were analyzed. Respondents were distributed across all 16 regions of Ghana, with a near-balanced representation across gender and education levels. The majority of respondents (63%) were between 18 and 35 years old, reflecting the demographic composition of active mobile data users in Ghana. MTN accounted for the largest share of subscribers (73%), followed by Vodafone (17%) and AirtelTigo (9%). Approximately 61% of users reported having been with their current provider for more than three years. These distributions indicate a sample that reflects the broader structure of the Ghanaian telecommunication market and is sufficiently heterogeneous for analytical purposes.

Preliminary Diagnostics and Reliability

Preliminary diagnostics confirmed the quality and suitability of the data for advanced analysis. Missing values were negligible (<1%), and no severe outliers were detected. The reliability of multi-item constructs was assessed using Cronbach's alpha. Reliability ($\alpha = 0.81$), responsiveness ($\alpha = 0.77$), assurance ($\alpha = 0.76$), empathy ($\alpha = 0.72$), and tangibles ($\alpha = 0.69$) all fell within acceptable bounds. The Service Sentiment Index (SSI), constructed from the standardized SERVQUAL items, also showed acceptable internal consistency ($\alpha = 0.73$). These results provide confidence that the underlying constructs are measured consistently.

Factor Structure of Service Quality Dimensions

Exploratory factor analysis using principal axis factoring and Promax rotation supported the dimensionality of the adapted SERVQUAL items. The Kaiser–Meyer–Olkin statistic (0.897) and a significant Bartlett's test ($p < .001$) indicated sampling adequacy and suitability for factor analysis. Four factors with eigenvalues greater than one emerged, jointly explaining 63.48% of the total variance.

The strongest factor comprised reliability, empathy, and assurance items, underscoring the Ghanaian context in which network performance and interpersonal service characteristics are strongly interlinked in shaping perceived service quality. Responsiveness items formed a distinct factor, while tangibles remained the weakest and most fragmented dimension, confirming its reduced relevance in digitally mediated service contexts. These results are consistent with contemporary findings that emphasize the dominance of performance-related and interpersonal dimensions in mobile QoSD evaluations.

Descriptive Statistics for Key Variables

Table 1 summarizes the descriptive statistics of the main variables.

Experienced sentiment (SSI) was normally distributed around zero, as expected from a standardized index, with moderate spread. Satisfaction remained moderate (mean = 3.14), suggesting that customers tolerate service quality issues but do not strongly endorse their providers.

Table 1.

Descriptive Statistics for Service Quality, Sentiment, and Satisfaction

Variable	Mean	SD	Min	Max
Reliability	3.06	0.98	1	5
Responsiveness	2.84	0.96	1	5
Assurance	3.27	0.91	1	5
Empathy	2.88	1.01	1	5
Tangibles	2.99	0.88	1	5

Satisfaction	3.14	1.12	1	5
SSI (Standardized Composite)	0.00	0.82	−1.85	+1.74
Recommendation	3.21	1.09	1	5

Note. Descriptive statistics are based on cleaned responses from the SERVQUAL questionnaire and computed SSI scores.

Expressed Sentiment: Text-Based Polarity Analysis

The open-ended responses were classified into three categories using VADER's compound score thresholds. Out of 536 responses:

1. Negative sentiment: 56.5% (n = 303)

2. Neutral sentiment: 26.3% (n = 141)

3. Positive sentiment: 17.2% (n = 92)

The dominance of negative sentiment indicates a high level of emotional dissatisfaction, even among respondents whose quantitative ratings fell within the moderate range. This supports the proposition that emotional expression is more critical and more volatile than structured cognitive evaluation.

A thematic analysis of textual responses revealed five dominant clusters of customer concerns:

1. Network reliability failures: dropped calls, slow or inconsistent data.

2. Perceived high cost of data packages.

3. Delayed or ineffective responses to complaints.

4. Concerns about unfair billing and bundle depletion.

5. Geographical coverage gaps, especially outside major urban centers.

These themes help contextualize the polarity scores and confirm that negative sentiment is primarily driven by reliability deficiencies and price-value considerations rather than interpersonal service issues.

Experienced Sentiment: Service Sentiment Index (SSI)

The SSI constructed as the mean of standardized scores across the five SERVQUAL dimensions ranged from −1.85 to +1.74. For interpretation and matrix construction, respondents were placed in three sentiment categories:

1. Low experienced sentiment: 29.5% (SSI ≤ −0.50)

2. Neutral experienced sentiment: 49.3% (−0.49 ≤ SSI ≤ 0.49)

3. High experienced sentiment: 21.3% (SSI ≥ +0.50)

The distribution indicates that while textual sentiment was predominantly negative, experienced sentiment, as measured by quantitative ratings, was more balanced. This divergence sets the stage for examining dual sentiment alignment.

Dual Sentiment Matrix: Alignment and Divergence

To explore the relationship between expressed and experienced sentiment, the two sentiment measures were cross-tabulated into a 3 × 3 matrix.

Table 2.

Dual Sentiment Matrix (Expressed × Experienced)

	Low SSI	**Neutral SSI**	**High SSI**
Negative Sentiment	142 (26.5%)	138 (25.7%)	23 (4.3%)
Neutral Sentiment	13 (2.4%)	91 (17.0%)	37 (6.9%)
Positive Sentiment	3 (0.6%)	35 (6.5%)	54 (10.1%)

Note. Expressed sentiment was derived using VADER polarity from open-ended responses; SSI was computed from SERVQUAL dimension z-scores.

The matrix reveals three critical insights:

1. Sentiment divergence is substantial. More than half of respondents expressing negative sentiment did not have correspondingly low SSI scores.

2. Emotional dissatisfaction outweighs cognitive dissatisfaction. Negative textual sentiment persists even when experiential ratings are moderate.

3. Only a minority (10.1%) simultaneously expressed and experienced positive sentiment, reflecting a small pool of advocates.

This divergence contributes a novel theoretical insight: *customers may express strong negative sentiment in narrative form even when their structured evaluations suggest tolerance or neutrality*.

Correlation Analysis

Pearson correlation coefficients showed that reliability had the strongest association with satisfaction ($r = .54$, $p < .001$), followed closely by the Service Sentiment Index (SSI) ($r = .51$, $p < .001$). Responsiveness ($r = .48$, $p < .001$), assurance ($r = .45$, $p < .001$), and empathy ($r = .43$, $p < .001$) also demonstrated significant positive relationships with satisfaction. Tangibles showed the weakest correlation ($r = .26$, $p < .001$), confirming its relatively limited role in shaping satisfaction within digital-service environments. The strong positive correlation between SSI and satisfaction further supports its role as a mediating emotional mechanism in the evaluation process.

Table 3

Correlation Matrix for SERVQUAL Dimensions, SSI, and Satisfaction

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Reliability	1						
2. Responsiveness	.64	1					
3. Assurance	.58	.55	1				

4. Empathy	.52	.49	.57	1			
5. Tangibles	.33	.29	.30	.28	1		
6. SSI	.46	.41	.38	.39	.19	1	
7. Satisfaction	.54	.48	.45	.43	.26	.51	1

Note. **p < .01 (two-tailed)**.

All correlations align with expected SERVQUAL patterns and support regression assumptions.

Regression Results

A multiple regression analysis was conducted to examine the extent to which service quality dimensions and the Service Sentiment Index (SSI) predict overall satisfaction. This is shown inTable 4. The full model, which included all five SERVQUAL dimensions together with SSI, explained 57% of the variance in satisfaction (R^2 = .57, Adjusted R^2 = .56), indicating a strong model fit, $F(6, 529) = 118.4$, $p < .001$.

Reliability emerged as the strongest predictor of satisfaction (β = .39, $p < .001$), reaffirming its central role in shaping customer evaluations in the telecom context. SSI also demonstrated a strong and statistically significant contribution (β = .32, $p < .001$), highlighting the importance of emotional sentiment in driving satisfaction beyond cognitive service quality assessments.

Among the classical SERVQUAL dimensions, responsiveness had a smaller but significant effect (β = .12, $p = .001$), while assurance (β = .06, $p = .061$) and tangibles (β = .05, $p = .079$) did not reach conventional significance levels. Empathy showed a modest but significant relationship with satisfaction (β = .10, $p = .004$).

Overall, the results demonstrate that both functional service performance (especially reliability) and experienced sentiment (SSI) jointly influence customer satisfaction, with reliability and sentiment emerging as the dominant predictors.

These results reaffirm the primacy of reliability in shaping satisfaction in the telecom environment.

Table 4

Regression Analysis Predicting Satisfaction

Predictor	B	SE	β	t	p
Constant	0.91	0.18	-	5.06	< .001
Reliability	0.41	0.05	.39	8.12	< .001
Responsiveness	0.13	0.04	.12	3.25	.001
Assurance	0.07	0.04	.06	1.88	.061
Empathy	0.11	0.04	.10	2.86	.004
Tangibles	0.05	0.03	.05	1.76	.079
SSI	0.38	0.06	.32	6.57	< .001

Note. Reliability is the strongest predictor; SSI is also a significant independent contributor.

Mediation Analysis: Reliability → SSI → Satisfaction

A mediation analysis was conducted using Hayes' PROCESS Macro (Model 4) with 5,000 bootstrap samples to examine whether experienced sentiment (SSI) serves as a mediating mechanism through which reliability influences overall satisfaction. The analysis revealed a significant effect of reliability on SSI ($\beta = 0.566$, $SE = 0.041$, $p < .001$), indicating that higher perceptions of reliability were strongly associated with more positive experienced sentiment. In turn, SSI significantly predicted satisfaction ($\beta = 0.381$, $SE = 0.060$, $p < .001$), showing that customers' emotional interpretations of service experiences play a substantive role in shaping their overall evaluations.

When SSI was included in the model, the direct effect of reliability on satisfaction remained significant ($\beta = 0.411$, $SE = 0.052$, $p < .001$), confirming that reliability exerts both a cognitive and affective influence on satisfaction. The indirect effect through SSI was statistically significant ($\beta = 0.216$), and the bootstrapped 95% confidence interval [0.142, 0.304] did not include zero, providing strong evidence of mediation. The total effect of reliability on satisfaction was substantial ($\beta = 0.627$, $SE = 0.044$, $p < .001$), indicating that reliability shapes satisfaction both directly and by influencing the emotional sentiment customers form during service encounters.

Overall, these results support a partial mediation model, demonstrating that while reliability remains the strongest determinant of satisfaction, part of its influence is transmitted through customers' experienced sentiment. This finding highlights the dual cognitive–affective nature of service evaluation, showing that reliability affects not only how customers think about service performance but also how they feel about it, both of which jointly shape their final satisfaction judgment.

Table 5

Mediation Analysis Summary (Reliability → SSI → Satisfaction)

Path	Effect	SE	t / z	p
Path a: Reliability → SSI	0.566	0.041	13.80	< .001
Path b: SSI → Satisfaction	0.381	0.060	6.35	< .001
Direct Effect (c'): Reliability → Satisfaction	0.411	0.052	7.90	< .001
Indirect Effect (a × b)	0.216	0.036	5.94	< .001
Total Effect	0.627	0.044	14.25	< .001
Bootstrapped 95% CI	0.142 – 0.304	-	-	-

Notes. Partial mediation is confirmed. Reliability influences satisfaction both directly and through emotional sentiment (SSI).

SUMMARY OF KEY FINDINGS

1. Reliability is the dominant service-quality predictor of satisfaction.

2. Expressed sentiment is overwhelmingly negative, but experienced sentiment is more moderate.

3. Dual sentiment analysis reveals substantial divergence between emotional and cognitive evaluations.

4. Sentiment (SSI) significantly mediates the reliability–satisfaction relationship.

5. Tangibles are not significant, reinforcing their reduced relevance in a digital-first telecom context.

DISCUSSION

The objective of this study was to examine the complex relationships among service quality perceptions, customer sentiment, and satisfaction in Ghana's mobile telecommunications sector by integrating classical SERVQUAL constructs with both experienced and expressed sentiment measures. The findings yield new theoretical and empirical insights that advance existing QoS literature and demonstrate the value of blending cognitive and affective evaluation frameworks.

The first major finding confirms that reliability is the dominant driver of customer satisfaction, consistent with decades of service quality research (Agyapong, 2011; Kim, Park, & Jeong, 2004; Ranaweera & Prabhu, 2003). In the Ghanaian context, this dominance is further amplified by the nation's widespread dependence on mobile data for daily economic transactions, education, financial inclusion, communication, and entertainment. Research on African and emerging markets demonstrates that mobile communication systems increasingly operate as foundational socio-economic infrastructure, supporting essential services and everyday activities rather than discretionary consumption (Aker & Mbiti, 2010; Donner, 2015). Thus, even marginal disruptions in call quality or data stability translate into substantial user dissatisfaction. This study reinforces earlier observations that QoS shortcomings, particularly in network reliability, have disproportionately large impacts on African mobile users due to limited alternative service options and infrastructural constraints (Oduro, Boachie-Mensah, & Agyapong, 2018; Shava, 2021).

However, this study contributes beyond confirming these relationships by addressing how reliability shapes satisfaction through emotional sentiment. The partial mediation effect of the Service Sentiment Index (SSI) indicates that customers do not evaluate telecom service purely through rational judgments; instead, reliability influences both cognitive assessments and affective experiences, which together drive satisfaction outcomes. This finding aligns with multi-dimensional models of customer experience (Lemon & Verhoef, 2016) and with the appraisal-emotion theories of consumer behaviour, which posit that service experiences elicit emotional responses that mediate behavioural outcomes (Oliver, 2014; Ladhari, 2009). The evidence that experienced sentiment significantly mediates the relationship between reliability and satisfaction suggests that any improvement in network quality will translate not only into better ratings but also into more positive emotional statesthereby enhancing overall satisfaction and potentially strengthening loyalty.

A second major contribution lies in the uncovering of sentiment divergence, a mismatch between expressed sentiment (textual emotional tone) and experienced sentiment (numeric SERVQUAL-derived evaluations). This divergence represents a critical extension to classical QoS theory. While SERVQUAL offers robust constructs for measuring service performance, it has long been critiqued for insufficiently capturing emotional and experiential nuances (Seth, Deshmukh & Vrat, 2005; Buttle, 1996). The present findings support these critiques: more than half of respondents expressed negative emotions in their open-ended responses, despite relatively moderate quantitative ratings on reliability, responsiveness, and empathy. This pattern mirrors findings from emerging text-mining literature, which shows that customers often suppress emotional intensity in structured ratings but reveal richer affective expressions in narrative comments (Ordenes et al., 2014; McColl-Kennedy et al., 2019).

The sentiment divergence observed in this study provides new empirical support for the argument that customer satisfaction is not a unidimensional construct. Rather, it comprises layered components: cognitive evaluations (ratings), affective expressions (sentiment), and behavioural inclinations (recommendations, complaints). In many cases, the affective layer may be more diagnostic of true dissatisfaction than structured ratings. For example, customers may tolerate unreliable service due to perceived lack of alternatives or contractual lock-ins (East et al., 2008; Dwivedi et al., 2021), yet still articulate frustration when given the freedom to express themselves. This is especially pronounced in Ghana, where mobile telecommunication services have near-universal penetration but vary in quality across regions, resulting in users who may remain with a provider despite persistent grievances.

The thematic analysis of expressed sentiment provides additional context. Respondents frequently mentioned network unreliability, high data costs, delays in resolving complaints, and concerns about billing accuracy. These

issues correspond with findings reported in Ghana's regulatory quality of service assessments (NCA, 2022) and with empirical evidence from studies of customer satisfaction in the domestic mobile telecom industry (Oduro, Boachie-Mensah, & Agyapong, 2018). Comparable observations appear in other African markets where service quality challenges continue to influence user satisfaction and perceived value (Chinomona & Sandada, 2014; Shava, 2021).

These emotional expressions reveal that psychological dissatisfaction often centres on structural and infrastructural challenges rather than staff behaviour or physical service elements. This is consistent with global shifts in service quality priorities within digital industries, where tangibles play a diminished role (Parasuraman, Zeithaml & Berry, 1988; Tam, 2012).

The factor analytic results further contextualize the Ghanaian telecom experience. The convergence of reliability, assurance, and empathy into a dominant factor suggests that Ghanaian consumers conceptualize service quality primarily in terms of performance reliability and trustworthiness, rather than in segmented SERVQUAL dimensions. This pattern aligns with research showing that technology-mediated service environments often reshape or compress traditional SERVQUAL structures, as customers evaluate digital services more holistically (Gummerus, 2014; Blut, Chowdhry, Mittal, & Brock, 2015; Parasuraman, Zeithaml, & Malhotra, 2005). The weaker influence of tangibles in this study corroborates arguments that digital service experiences require updated quality models emphasizing system performance, responsiveness, interface quality, and emotional engagement rather than traditional physical cues (Zeithaml, Bitner, & Gremler, 2018).

The introduction of the dual sentiment framework represents one of the study's strongest methodological contributions. By integrating experienced sentiment (SSI) with expressed sentiment (text-based polarity), this study demonstrates how quantitative and qualitative data can produce a more holistic understanding of customer perceptions. Researchers increasingly advocate integrating NLP-based sentiment analysis with structured survey data to obtain a more comprehensive understanding of customer experience. Recent studies demonstrate that text analytics can reveal emotional nuances not captured by rating scales, and that combining qualitative and quantitative sentiment improves service evaluation accuracy (Ordenes et al., 2014; McColl-Kennedy et al., 2019; Tirunillai & Tellis, 2014). Despite this progress, very few studiesparticularly within African telecom markets have operationalized a dual-sentiment framework or examined how cognitive service evaluations and emotional expressions diverge in shaping customer satisfaction.

The dual sentiment matrix developed in this study reveals patterns that classical QoS metrics cannot capture. The existence of respondents with high SSI (indicating positive cognitive evaluations) but negative expressed sentiment (indicating emotional dissatisfaction) is theoretically important. These customers may be at heightened risk of engaging in negative word-of-mouth or complaint behaviour, even when they maintain moderate satisfaction. Conversely, customers who express positive emotions but give moderate ratings may represent latent advocates who emotionally endorse the brand despite functional shortcomings. These distinctions offer real-world implications for telecom providers, suggesting that customer experience strategies must target not only functional service improvements but also emotional engagement.

From a regulatory perspective, the findings underscore the need for more nuanced QoS monitoring frameworks that incorporate sentiment analytics. Traditional QoS metrics such as call-drop rates, data throughput, coverage offer quantitative benchmarks but do not capture emotional dissatisfaction, which is often a precursor to consumer agitation and public complaints. The adoption of sentiment-based indicators could strengthen early warning systems for emerging QoS crises and help regulators such as the NCA design more targeted interventions.

In summary, this study deepens theoretical understanding by demonstrating that customer satisfaction in telecom services emerges from the integration of cognitive evaluations, affective interpretations, and emotional expressions. The dual sentiment framework provides a richer lens for understanding telecom customer experiences in emerging markets. The results place Ghana's telecom sector within broader global debates on service experience, contribute to evolving theories of sentiment in service evaluation, and offer actionable insights for providers seeking to enhance satisfaction in a competitive but infrastructurally complex market.

CONCLUSION

The purpose of this study was to examine how service quality perceptions and customer sentiment jointly shape customer satisfaction within the Ghanaian mobile telecommunications sector. By integrating the SERVQUAL model with both experienced sentiment (measured through the Service Sentiment Index) and expressed sentiment (derived from open-ended responses), the study offers a comprehensive and multidimensional understanding of Quality of Service Delivery (QoSD). The findings demonstrate that customer evaluations in this sector are not solely shaped by cognitive assessments of service attributes but are significantly influenced by affective sentiment and emotional expression.

The study confirms that reliability remains the most influential determinant of satisfaction, reinforcing its centrality within the telecom service experience. In an environment where mobile communication is essential for economic and social activity, network stability, data performance, and consistent connectivity naturally dominate user expectations. However, a key contribution of this research is the discovery that the influence of reliability extends beyond cognitive evaluation: it also exerts a significant indirect effect through sentiment, supporting the argument that emotions form a fundamental part of the satisfaction process. The partial mediation of reliability on satisfaction by sentiment underscores the dual cognitive–affective pathways through which service quality affects user outcomes.

A major theoretical advancement introduced by this study is the concept of sentiment divergence, the mismatch between customers' structured ratings and their emotional expressions. Despite moderate SERVQUAL ratings for many respondents, the majority expressed negative sentiments in their open-ended responses. This divergence reveals that structured Likert scales may underestimate the level of emotional dissatisfaction and that text-based sentiment analysis provides a more sensitive indicator of service pain points. By operationalizing the dual-sentiment framework, this study demonstrates that cognitive and affective evaluations may align, partially diverge, or strongly contradict each other, with important implications for customer experience management.

The thematic patterns of expressed sentiment also highlight structural weaknesses that continue to undermine user perceptions in Ghana's telecom sector, including network unreliability, high data costs, inefficient complaint handling, and billing concerns. These issues mirror findings from broader African studies and emphasize the need for sustained infrastructural investment and enhanced customer service mechanisms. The limited relevance of tangibles and the convergence of reliability, assurance, and empathy into a core factor further illustrate that Ghanaian consumers now judge service quality primarily on functional performance and trustworthiness rather than physical service cues.

Methodologically, this study demonstrates the value of integrating numeric and textual analytics within QoS research. The combination of SERVQUAL measures, sentiment indexing, and natural language sentiment extraction provides a richer empirical basis for understanding customer experiences than traditional methods alone. The dual sentiment matrix developed herein represents a novel analytical tool capable of identifying nuanced customer groupssuch as those who are cognitively tolerant but emotionally dissatisfied, thereby offering actionable insights for both researchers and practitioners.

Overall, this study contributes to theory by expanding service quality models to incorporate emotional sentiment as both an evaluative dimension and a mediating mechanism. Empirically, it provides evidence from a developing-country telecom market where emotional dissatisfaction coexists with moderate cognitive evaluations. Practically, the findings highlight the need for telecom operators and regulators to monitor both functional QoS indicators and customer sentiment patterns to improve service outcomes and strengthen user trust.

The dual-sentiment framework offers a foundation for future studies seeking to integrate emotional analytics into service evaluation. As telecommunications become increasingly intertwined with digital life and economic participation, understanding how users both perceive and feel about service quality will become essential to enhancing satisfaction, reducing churn, and improving industry-wide performance.

Implications

The findings of this study yield several important implications for theory, managerial practice, and telecommunications regulation. By incorporating both SERVQUAL-based evaluations and dual sentiment measures, the study reveals new pathways through which customers interpret and react to service experiences.

Theoretical Implications

First, the study contributes to service quality literature by demonstrating that traditional SERVQUAL constructs alone cannot fully explain customer satisfaction in telecom environments. The discovery that experienced sentiment (SSI) partially mediates the impact of reliability on satisfaction highlights the need to integrate affective components into established models such as SERVQUAL, SERVPERF, and customer value frameworks. This advances cognitive–affective integration theories (Oliver, 2014; Lemon & Verhoef, 2016) and supports calls for expanded multidimensional models in digital service contexts.

Second, the identification of sentiment divergence where customers express strong negative emotions despite moderate service ratings extends theories of customer dissatisfaction and behavioural intention. This suggests that future models must treat emotional expression as a distinct construct rather than assuming alignment with cognitive evaluation. The dual-sentiment matrix pioneered in this study provides a framework for capturing such mismatches and can be applied in other service industries where customers may suppress emotional dissatisfaction in structured responses.

Third, the study strengthens emerging literature on sentiment analytics by showing the value of combining text-derived sentiment with psychometric sentiment indicators. This methodological contribution suggests that customer experience research can benefit from hybrid data strategies that use both quantitative and qualitative insights to more accurately capture the emotional dimension of service evaluation.

Managerial and Industry Implications

For telecom operators in Ghana, the results underscore the centrality of network reliability in influencing both affective sentiment and overall satisfaction. Investments in infrastructure particularly in data stability, network congestion management, and wider coverageare likely to yield the greatest satisfaction improvements. Operators should prioritise predictive network monitoring, real-time quality-of-service dashboards, and proactive communication during outages to mitigate negative emotional reactions.

The findings also highlight the value of integrating sentiment analytics into customer feedback systems. Traditional surveys often fail to reveal underlying emotional dissatisfaction. Telecom managers should therefore use sentiment-based feedback from social media, call-centre logs, and open-ended survey responses to detect emerging issues earlier and tailor interventions more precisely. Customers whose expressed sentiment is negative but whose cognitive evaluations are moderate may require targeted communication strategies to prevent negative word-of-mouth or churn.

Furthermore, the limited influence of tangibles suggests that operators should redirect resources from physical service touchpoints to digital and experiential improvements. Enhancing mobile app usability, transparent pricing communication, digital self-service tools, and rapid complaint resolution mechanisms will better meet user expectations.

Policy and Regulatory Implications

The results offer important insights for telecommunications regulators such as the National Communications Authority (NCA). Traditional QoS frameworks that focus only on call-drop rates, data throughput, and coverage metrics may not sufficiently reflect user experiences. The emotional dissatisfaction detected through sentiment analysis indicates the need for regulatory QoS monitoring frameworks that incorporate both performance indicators and customer sentiment indicators.

Regulators could incorporate sentiment analytics into consumer complaint management systems to identify geographic or provider-specific dissatisfaction clusters. Integrating sentiment indicators into periodic QoS evaluations would enable earlier detection of dissatisfaction trends and more proactive interventions. Additionally, the evidence that customers express emotional frustrations tied to billing and complaint resolution suggests that regulatory oversight should extend beyond technical metrics to include customer service processes, billing transparency, and fairness in data depletion algorithms.

LIMITATIONS AND FUTURE RESEARCH

Despite its contributions, this study is subject to several limitations that suggest important avenues for future research.

First, the study relies on convenience sampling, which may limit the generalizability of the results to the entire population of Ghanaian mobile telecom users. While the sample size is robust and geographically diverse, future studies may adopt stratified random sampling or operator-based sampling frames to enhance representativeness.

Second, sentiment classification in this study was based on VADER, a lexicon-based model designed primarily for general English text. Although VADER performs well on short informal messages, it may not fully capture linguistic nuances, sarcasm, multilingual expressions, or culturally embedded terms common in Ghana. Future research may benefit from supervised machine learning models trained on Ghana-specific telecom sentiment corpora or transformer-based models such as BERT or RoBERTa fine-tuned for local text.

Third, the cross-sectional design precludes causal inferences beyond mediation modelling. Longitudinal or panel-based designs could examine how sentiment and satisfaction evolve over time, particularly during network disruptions, promotional campaigns, or regulatory interventions. Time-series sentiment monitoring would yield deeper insights into the dynamic emotional states of customers.

Fourth, the study focuses on SERVQUAL dimensions and sentiment but does not explicitly incorporate behavioural outcomes such as actual churn, switching intention, or digital engagement. Future studies could link sentiment divergence to behavioural metrics or use predictive modelling to determine whether emotionally negative customers with moderate satisfaction are more likely to churn.

Fifth, while the dual sentiment matrix reveals important divergence patterns, it does not explore potential demographic moderators or contextual variables (e.g., urban vs. rural disparities, prepaid vs. postpaid differences). Multigroup analysis or structural equation modelling (SEM) could enrich the understanding of how sentiment and service quality interact across different user segments.

Finally, the study is situated in Ghana's telecommunications sector, which has unique infrastructural and competitive characteristics. Cross-country comparative studies across West Africa or other developing markets could determine whether the dual-sentiment patterns observed here are universal or context-specific.

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