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SERVICE RELIABILITY AND CUSTOMER SATISFACTION IN SEMI-RURAL PUBLIC UTILITIES: EVIDENCE FROM NJUWASA, TANZANIA

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1. ABSTRACT

In Tanzania's water sector, where only 54% of urban populations enjoy reliable access (World Bank, 2023), service reliability remains a critical yet understudied driver of customer satisfaction, particularly in semi-rural utilities. This study examines the impact of service reliability measured through water supply consistency, billing accuracy, and complaint resolution on customer satisfaction at Njombe Urban Water Supply and Sanitation Authority (NJUWASA). Using the SERVQUAL model, data were collected from 385 stratified-sampled customers via structured questionnaires. SPSS analysis revealed a strong positive correlation between reliability and satisfaction ($r = 0.78$, $p < 0.01$), with reliability explaining 61% of satisfaction variance ($R^2 = 0.61$). Billing reliability was a strength (mean = 3.4/5), but frequent interruptions (68% of customers monthly) and delayed complaint resolution (mean = 2.5/5) undermined satisfaction. NJUWASA should prioritize infrastructure upgrades, real-time communication (e.g., SMS alerts), and community engagement to align with Sustainable Development Goal (SDG) 6's targets for equitable water access. This study offers a replicable framework for utilities in resource-constrained settings, emphasizing proactive maintenance and inclusive governance to bridge service gaps.

KEYWORDS: *Service Reliability, Customer Satisfaction, SERVQUAL, SDG 6, Tanzania, Public Utilities*

2. INTRODUCTION

In Tanzania's semi-rural regions, public utilities like the Njombe Urban Water Supply and Sanitation Authority (NJUWASA) are vital for providing water and sanitation services, underpinning public health and economic stability. Tanzania's progress toward SDG 6 ensuring clean water and sanitation for all is hampered by semi-rural service gaps, where utilities like NJUWASA struggle with aging infrastructure and limited resources (UN Water, 2023). Only 54% of Tanzania's urban population has reliable water access (World Bank, 2023), reflecting systemic challenges. While SERVQUAL's reliability dimension is well-documented in urban utilities (Parasuraman et al., 1988), its applicability to semi-rural contexts where infrastructure deficits exacerbate service gaps remains underexplored, particularly in achieving SDG 6's equity targets. Customer satisfaction, a key service quality measure, is shaped by reliability, accessibility, and affordability (Kosteroglou et al., 2016; Musoke & Mugisha, 2020). At NJUWASA, anecdotal reports highlight dissatisfaction due to frequent disruptions, billing inaccuracies, and delayed complaint resolution (NJUWASA, 2021).

This study investigates how service reliability measured through water supply consistency, billing accuracy, and complaint resolution efficiency affects customer satisfaction at NJUWASA. Using a quantitative approach, data were collected from 385 customers via stratified random sampling and analyzed with SPSS. Anchored in SERVQUAL, the research explores reliability's interplay with customer perceptions in a resource-constrained setting (Mkundya, 2022). The findings aim to provide actionable recommendations for NJUWASA to enhance service delivery, align with SDG 6, and enrich the literature on service quality in African public utilities, offering a replicable framework for semi-rural utilities.

3. LITERATURE REVIEW

3.1Conceptual Definitions

- **Customer Satisfaction**: A measure of how well services meet or exceed expectations, reflecting contentment with service interactions (ASQ, 2023). This suits the study's quantitative focus on satisfaction at NJUWASA, where trust and loyalty are critical (Zeithaml et al., 2018).

- **Service Reliability**: The consistency and dependability of service delivery, including uninterrupted water supply, accurate billing, and timely complaint resolution (Parasuraman et al., 1988). It is central to NJUWASA's semi-rural mandate.
- **Public Utilities**: Government-regulated entities delivering essential services like water, often as natural monopolies due to high infrastructure costs (Beecher, 2016).

3.2Theoretical Framework

The SERVQUAL model (Parasuraman et al., 1988) underpins this study, assessing service quality via the gap between customer expectations and perceptions across tangibles, reliability, responsiveness, assurance, and empathy. Reliability delivering promised services dependably is prioritized due to its role in water utilities (Kosteroglou et al., 2016). While SERVQUAL's reliability dimension is central, its static nature may overlook dynamic solutions like mobile-based feedback systems (Zhang & Wu, 2024), which could address NJUWASA's complaint resolution delays. Cost, though excluded from SERVQUAL, is analyzed separately given its impact on affordability in SDG 6-aligned service delivery (Mkundya, 2022). Tangibles are deprioritized, as functional delivery trumps aesthetics in semi-rural utilities (Beecher, 2016).

3.3Empirical Review

- **Global Evidence**: Reliability drives satisfaction in utilities. Kosteroglou et al. (2016) found consistent service delivery outweighs empathy. Jou et al. (2023) and Mahmoos et al. (2024) noted interruptions erode trust in water utilities in the Philippines and Pakistan.
- **African Context**: Reliability and affordability are key. Ohwo and Agusomu (2018) identified reliable service as vital in Nigeria, while Musoke and Mugisha (2020) in Uganda emphasized consistent water supply.
- **Tanzanian Challenges**: Infrastructure constraints exacerbate reliability issues. Mkundya (2022) reported a strong correlation between reliable supply and satisfaction. Kundi (2018) highlighted resource mobilization, and Peter and Batonda (2022) found reliability critical in Tanzania's energy sector.

3.4 Research Gap

Existing research confirms reliability's role but lacks localized studies on Tanzania's semi-rural water utilities using SERVQUAL. No prior Tanzanian studies examine how reliability dimensions collectively impact satisfaction in semi-rural utilities, despite their centrality to SDG 6's mandate for equitable service. Studies like Johnson and Karlay (2018) and Tesfaye (2019) focus on unrelated sectors, while Peter and Batonda (2022) address energy. NJUWASA's unique challenges (intermittent supply, aging infrastructure) remain understudied, necessitating targeted research proposing mobile-enabled solutions.

4. METHODOLOGY

4.1Research Design

This study employs a descriptive, quantitative design to examine service reliability's impact on customer satisfaction at NJUWASA, enabling detailed analysis of satisfaction and reliability correlations (Saunders et al., 2016).

4.2 Study Area

The study focuses on NJUWASA, a public utility in Tanzania's semi-rural Njombe region, selected for its representative challenges (aging infrastructure, resource constraints) and stakeholder access (Beecher, 2016).

4.3 Population and Sampling

The target population includes 9,882 NJUWASA customers (9,582 domestic, 169 institutional, 131 commercial) per the Maji Information System (2025). A sample of 385 customers was calculated using Yamane's (1967) formula: $n = N / [1 + N(e^2)]$, where N = 9,882, e = 0.05, yielding $n \approx 385$. Stratified random sampling ensured proportional representation (373 domestic, 7 institutional, 5 commercial). Non-customer stakeholders were excluded to focus on user perceptions (Creswell & Creswell, 2018).

4.4 Data Collection

Primary data were collected via structured questionnaires with closed-ended, 5-point Likert-scale questions (1 = Strongly Disagree, 5 = Strongly Agree), measuring reliability (e.g., interruptions, billing accuracy, complaint

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resolution) and satisfaction. Secondary data from NJUWASA's 2021 reports provided context. Data collection spanned six months in Njombe Township (Kumar, 2019).

4.5 Analysis

SPSS was used for analysis. Descriptive statistics (frequencies, means, standard deviations) summarized demographics and reliability perceptions. Inferential statistics (Pearson correlation, regression) modeled the relationship: $Y = \beta 0 + \beta 1X1 + \epsilon$, where Y is satisfaction, $X1$ is reliability, $\beta 0$ is the intercept, $\beta 1$ is the coefficient, and ϵ is the error term. Regression assumptions were tested via SPSS diagnostics (Tabachnick & Fidell, 2019). The 5-point Likert scale, while simplifying responses, may obscure nuanced perceptions; future studies could use mixed methods to capture qualitative depth.

4.6 Validity and Reliability

Content validity was ensured through expert consultation and a pre-test with 20 NJUWASA customers. Reliability was confirmed via Cronbach's alpha (≥ 0.7) and test-retest procedures (Saunders et al., 2019).

4.7 Ethical Considerations

Permissions were obtained from NJUWASA and the Open University of Tanzania. Informed consent ensured participants understood the study's purpose and withdrawal rights. Data were anonymized and securely stored (American Psychological Association, 2017).

5. RESULTS

5.1 Descriptive Findings

Of 385 respondents, 68% reported monthly water supply interruptions, highlighting a major reliability issue. Billing reliability scored a mean of 3.4/5 (SD = 0.9), indicating moderate satisfaction, while complaint resolution timeliness scored 2.5/5 (SD = 1.1), reflecting dissatisfaction. Overall satisfaction averaged 2.8/5 (SD = 1.0), suggesting improvement potential. Figure 6.1 (below) illustrates these metrics via a bar chart comparing mean scores across reliability dimensions and satisfaction.

Table 5.1: Table Representation:

Metric	Mean Score (1-5)	SD	Observation
Water Interruptions	1.8	-	68% reported monthly interruptions
Billing Reliability	3.4	0.9	Moderate satisfaction
Complaint Resolution Timeliness	2.5	1.1	Reflects dissatisfaction
Overall Customer Satisfaction	2.8	1.0	Significant improvement potential

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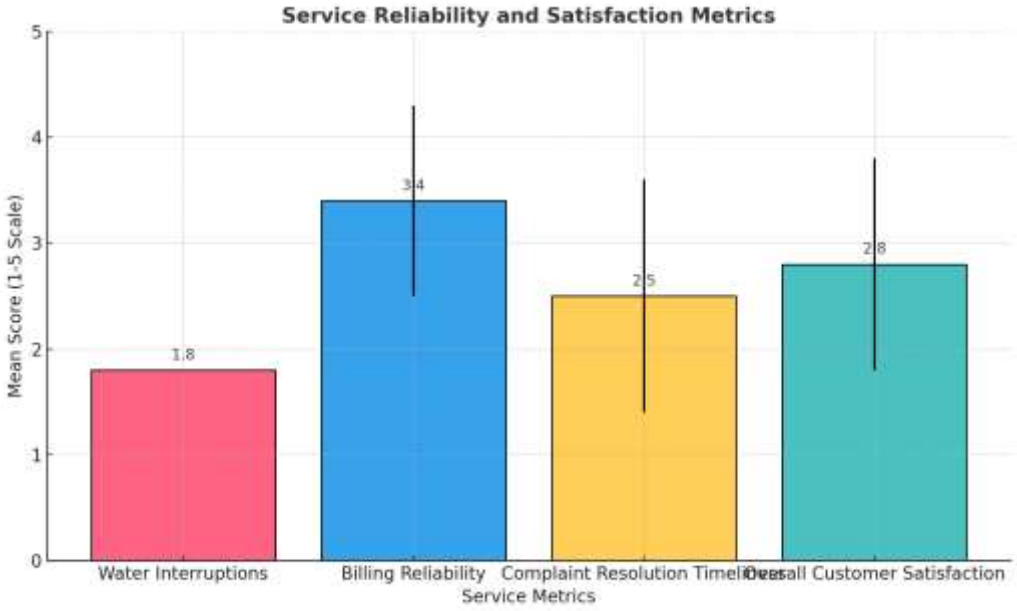
Figure 5.1: Service Reliability and Satisfaction Metrics
The bar chart below represents the service reliability and satisfaction metrics based on the data provided:



5.2 Inferential Findings
Pearson correlation showed a strong positive relationship between reliability and satisfaction ($r = 0.78$, $p < 0.01$). Regression analysis indicated reliability significantly predicts satisfaction ($B = 0.65$, $p < 0.01$), with an R^2 of 0.61, meaning 61% of satisfaction variance is explained by reliability. Billing accuracy was the strongest contributor (mean = 3.4/5), while interruptions and delayed complaint resolution were key detractors.

6. DISCUSSION

The strong correlation ($r = 0.78$) and explanatory power ($R^2 = 0.61$) confirm reliability's critical role in satisfaction at NJUWASA, aligning with global studies (Kosteroglou et al., 2016; Setiono & Hidayat, 2022). The 68% monthly interruption rate directly contravenes SDG 6's target of "reliable and safe service for all," urging NJUWASA to align infrastructure investments with national SDG benchmarks (URT, 2022). Unlike Dar es Salaam's DAWASA, where interruptions average 30% (World Bank, 2023), NJUWASA's semi-rural challenges highlight SDG 6's urban-rural equity imperative. Billing reliability (mean = 3.4/5) suggests effective systems, unlike complaint resolution (mean = 2.5/5), which undermines trust (Peter & Batonda, 2022). The SERVQUAL model's reliability focus was apt, though its static framework may miss mobile-based solutions (Zhang & Wu, 2024). Excluding tangibles was justified, as functional delivery trumps aesthetics in semi-rural utilities (Beecher, 2016). The findings support Tanzania's SDG 6 goals by highlighting reliability as a lever for equitable water access.

7.LIMITATIONS

The single-utility focus limits generalizability, and potential response bias may skew results. Excluding other SERVQUAL dimensions (e.g., empathy) narrows the perspective, and cross-sectional data miss temporal trends.

8.CONCLUSION AND RECOMMENDATIONS

This study confirms that service reliability drives customer satisfaction at NJUWASA, explaining 61% of satisfaction variance. Frequent interruptions (68% monthly) and delayed complaint resolution (mean = 2.5/5) are key barriers, while billing reliability (mean = 3.4/5) is a strength. Addressing reliability gaps can position NJUWASA as a model for semi-rural utilities striving for SDG 6's equitable water access goals.

8.1 Recommendations

- **Infrastructure Upgrades**: Modernize pipelines and storage systems to reduce the 68% interruption rate, targeting SDG 6.1's "universal access" mandate.
- **Proactive Maintenance**: Implement regular maintenance to ensure consistent supply.
- **Mobile Technology**: Deploy SMS alerts for outages and resolutions, leveraging Tanzania's 84% mobile penetration (ITU, 2023) to meet SDG 6's "participatory management" targets.
- **Community Engagement**: Partner with local leaders to co-design service improvements, aligning with SDG 6's emphasis on inclusive governance.
- **Staff Training**: Enhance skills in complaint handling and billing accuracy.

9.FUTURE RESEARCH

Longitudinal studies tracking SDG 6 progress post-intervention and comparative analyses of utilities in similar SDG 6 "priority regions" (e.g., Mbinga) could validate findings.

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APPENDICES

Appendix I: Questionnaire

SECTION A

INTRODUCTION

Respondent ID: _____

This questionnaire assesses factors influencing customer satisfaction at NJUWASA. Responses are for academic purposes only and will remain confidential.

SECTION B: DEMOGRAPHICAL INFORMATION

1. Gender: (a) Male (b) Female
2. Age: (a) 18–24 (b) 25–34 (c) Above 35
3. Education Level: (a) Secondary (b) Higher Education (c) Technical
4. Occupation: (a) Administrative (b) Technical (c) Supportive

SECTION C:

OBJECTIVE QUESTIONS

Objective I: Impact of Service Reliability on Customer Satisfaction

Rate the following (SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree):

1. NJUWASA provides a consistent and uninterrupted water supply.
2. NJUWASA addresses service issues promptly and effectively.
3. The water supplied by NJUWASA meets expected quality standards.
4. NJUWASA ensures timely communication of scheduled service interruptions.
5. NJUWASA provides reliable billing services with minimal errors.

Sample Question: How often do you experience water supply interruptions? (a) Never (b) Rarely (c) Monthly (d) Weekly (e) Daily

Main Objective: Customer Satisfaction

1. I am satisfied with the overall quality of water supply services provided by NJUWASA.
2. NJUWASA provides reliable and consistent water supply services.

SDG 6 Alignment: How could NJUWASA better align its services with SDG 6's goals for clean water and sanitation? (Open-ended)