

Community Awareness on Pipe-Borne Water Infrastructure and The Well-Being of Rural Inhabitants in the Southern Senatorial District of Cross River State, Nigeria

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DOI: <https://doi.org/10.51244/IJRSI.2026.1308000166>

Received: 19 August 2026; Accepted: 24 August 2026; Published: 12 September 2026

ABSTRACT

This study investigated the impact of community awareness and participation on pipe-borne water infrastructure and the well-being of rural inhabitants in the Southern Senatorial District of Cross River State, Nigeria. A mixed-methods research design was adopted, combining a structured questionnaire survey with qualitative focus group discussions and key informant interviews. A sample of 400 respondents was drawn from an estimated population of 1,877,554 individuals across seven local government areas using a multi-stage sampling technique; the sample size was determined using the Yamane (1967) formula at a 5% margin of error. Pearson Product Moment Correlation Analysis was used to test the hypotheses at a .05 level of significance. The results revealed that community participation in pipe-borne water infrastructure had a significant positive relationship with the well-being of rural inhabitants ($r = 0.52$, $p < .05$). Conversely, community awareness of pipe-borne water infrastructure did not have a statistically significant relationship with the well-being of rural inhabitants ($r = 0.033$, $p > .05$), indicating that awareness alone, without corresponding participation and resource provision, is insufficient to improve rural well-being. The findings are interpreted within the framework of the Integrated Rural Development Theory, which posits that multisectoral, community-centred interventions are prerequisites for sustainable rural welfare. It is recommended that government agencies, in collaboration with civil society organisations and development partners, implement structured awareness campaigns, community water management committees, and sustained infrastructure investments with clearly defined timelines and accountability mechanisms.

Keywords: Community Awareness, Rural Inhabitants, Community Participation, Pipe-Borne Water Infrastructure, Socio-Economic Development, Cross River State

INTRODUCTION

The provision of safe, potable water remains one of the most pressing challenges confronting rural communities in sub-Saharan Africa. In Nigeria, the rural water supply crisis intersects with deficiencies in community awareness, inadequate infrastructure maintenance, and systemic governance failures. The Southern Senatorial District of Cross River State epitomises this challenge: despite being one of the more densely populated rural zones in the South-South geopolitical region, the majority of its inhabitants continue to rely on unsafe water sources for domestic use, including streams, unprotected wells, and seasonal rainwater.

Rural communities across Nigeria have suffered persistent setbacks attributable to limited community participation in decision-making processes, poor awareness of available water infrastructure, and inadequate

governmental provisioning of pipe-borne water services. Balogun, Yusuf, and Carim-Sanni (2019) noted that inadequate and poor-quality infrastructure carries serious implications for household welfare and perpetuates cycles of poverty. The Southern Senatorial District, encompassing seven local government areas, that includes: Biase, Akamkpa, Odukpani, Calabar Municipality, Calabar South, Akpabuyo, and Bakassi is not exempted from these structural deficiencies.

Public infrastructure constitutes a cornerstone of rural welfare and community progress (Opawole, Bababola, & Babatunde, 2012). Babatunde and Ilias (2020) affirmed that rural infrastructure plays a critical role in sustainable socio-economic development, political stability, and the improvement of living standards. Despite these acknowledged benefits, Babatunde and Ilias estimated that approximately 65% of Nigerians lack regular electricity supply, while fewer than 35% of the rural population has reliable access to safe drinking water, conditions that directly undermine health outcomes and economic productivity.

This study was therefore designed to investigate two interrelated dimensions of the problem: first, the extent to which community participation in pipe-borne water infrastructure influences the well-being of rural inhabitants; and second, whether community awareness of pipe-borne water infrastructure has a discernible effect on rural well-being in the Southern Senatorial District of Cross River State. The specific objectives are: (i) to examine the relationship between community participation in pipe-borne water infrastructure and the well-being of rural inhabitants; and (ii) to determine the relationship between community awareness of pipe-borne water infrastructure and the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

The findings of this study are expected to be of value to academic researchers, development partners, policy makers, and community leaders who seek evidence-based strategies for improving rural water infrastructure governance. Recommendations arising from this study may also serve as a practical guide for repositioning the activities of community-based organisations and relevant government ministries in Cross River State.

Statement of the Problem

Rural communities in Nigeria continue to suffer from a multiplicity of development deficits, among which the inadequate provision of safe, pipe-borne water is among the most critical. In the Southern Senatorial District of Cross River State, these deficits manifest in the form of absent or non-functional water infrastructure, limited community awareness of existing water facilities, and insufficient community participation in infrastructure planning, implementation, and maintenance.

The consequences of these shortfalls are severe. Rural inhabitants are exposed to waterborne diseases, which includes: Cholera, diarrhoea, and Guinea worm infestation, that arise from consumption of untreated surface water. The absence of safe water supply also imposes heavy burdens on women and children, who routinely travel long distances to fetch water, reducing time available for education, economic activities, and self-improvement. The socio-economic development of the Southern Senatorial District is thus fundamentally constrained by the unresolved water infrastructure crisis. This study addresses that crisis by generating empirical evidence on the relationship between community awareness, community participation, and the well-being of rural inhabitants.

LITERATURE REVIEW

Community Participation and Pipe-Borne Water Infrastructure

Pipe-borne water refers to a quality-controlled water supply delivered through a reticulated distribution network, and is regarded as substantially superior to surface water sources in terms of microbiological safety (Patrick, Berendes, Murphy, Bertrand, Husain, & Handzel, 2013). Individual and community participation is of critical significance to the fundamental development and transformation of rural water systems. Patrick et al. (2013) observed that participation is particularly vital in post-crisis contexts where local governance structures must compensate for weakened national systems.

The consumption of untreated water exposes rural inhabitants to cholera, an acute infectious disease caused by the bacterium *Vibrio cholerae*, as well as other parasitic and bacterial infections. Etienne, Tappero, Marston,

Frieden, Kenyon, and Andrus (2013) established that untreated, unfiltered, and unchlorinated water constitutes a significant public health hazard, with cholera mortality rates rising substantially in under-resourced rural settings. Many communities in the Southern Senatorial District suffer preventable diseases precisely because of poor community engagement in the planning and maintenance of pipe-borne water schemes.

In recognition of these challenges, federal initiatives such as the Directorate of Food, Roads, and Rural Infrastructure (DFRRI) were established to address basic infrastructure needs — including food security, shelter, and potable water, in rural Nigeria. The Cross-River State Government similarly established the Cross-River Water Board to administer water supply services. However, the functional capacity of such institutions has declined markedly, weakening service delivery and deepening infrastructure deficits in rural communities (Portal, Kemajuan, & Wilayah, 2017).

Mabuza and Aja (2019) conducted a study in Eswatini (formerly Swaziland) and found that the primary drivers of rural water scheme failure included the imposition of inappropriate technologies, unavailability of spare parts, absence of local maintenance capacity, poor community education, weak demand-side governance, and inadequate inter-agency coordination. Their findings underscore that sustainable water supply depends not merely on physical infrastructure but on the active participation of community members in governance, maintenance, and advocacy.

Community Awareness and Pipe-Borne Water Infrastructure

Water safety and potability are prerequisites for the maintenance of life and for the promotion of healthy rural environments (Ikelegbe & Okuruwa, 2017). Despite this acknowledged importance, Ikelegbe and Okuruwa argued that the primary challenges confronting pipe-borne water distribution in Nigeria are attributable to inadequate planning, poor awareness creation, and mismanagement by both government agencies and community members. They noted that existing infrastructure in many communities is insufficient to serve even 35% of the resident population, leading to conflict, facility damage, and deteriorating public health.

Adekunla (2011) argued that water scarcity affects all social and economic sectors and fundamentally threatens the sustainability of natural resource systems in rural communities. Addressing scarcity requires a sectoral and multidisciplinary approach that integrates community development, awareness creation, infrastructure utilisation, and demand management. The author maintained that accurate inventory of existing water infrastructure is necessary to enhance water productivity, support rural livelihoods, and reduce poverty.

Luis and Alejandro (2018) estimated the economic impact of public infrastructure on growth in eight regions of Oaxaca, Mexico, over the period 2003–2013 and found that social infrastructure — including water supply — demonstrated the greatest positive impact on regional economic growth, while investment had been consistently insufficient and misallocated. Their finding that women in water-scarce rural communities travel more than three hours daily to collect minimal water supplies vividly illustrates the welfare cost of awareness and infrastructure deficits. Experts have estimated that universal access to sanitary water supply could eliminate approximately half of all diarrhoeal disease cases, 90% of cholera incidence, 85% of sleeping sickness, and 100% of Guinea worm infestation cases globally.

John (2015) observed that the dispersion of rural settlements makes house-to-house water supply prohibitively expensive for governments, creating a structural disincentive to infrastructure investment. This cost barrier reinforces the importance of community-driven approaches in which inhabitants actively advocate for, co-design, and maintain local water schemes.

THEORETICAL FRAMEWORK

Integrated Rural Development Theory

This study is anchored in the Integrated Rural Development (IRD) Theory, originally propounded by Cohen (1987) in response to Robert McNamara's (1973) landmark articulation of absolute poverty in developing nations. The IRD theory posits that sustainable rural development cannot be achieved through isolated, sector-specific interventions; rather, it requires a holistic, multisectoral approach that simultaneously addresses

economic production, social services, community governance, and infrastructure provision as mutually reinforcing dimensions of rural welfare.

Theoretical Operationalisation. In this study, the IRD theory is operationalised across three dimensions that directly correspond to the research objectives and measurement instruments:

1. **Multisectoral Infrastructure Provision.** IRD theory argues that pipe-borne water infrastructure cannot be conceived in isolation from agriculture, health services, economic activity, and community governance. This principle informs Research Objective 1 (community participation and well-being) by directing measurement toward holistic well-being indicators — health status, economic productivity, and household livelihood — rather than single-sector outcomes. The questionnaire items measuring well-being were designed to capture this multidimensional conception, consistent with IRD's insistence that benefits must be distributed across all aspects of community life.
2. **Community-Centred Participation.** A foundational premise of IRD theory is that rural inhabitants must be positioned at the centre of development processes, not as passive recipients but as active agents who contribute knowledge, resources, and governance capacity. This principle directly informs Research Objective 2 (community awareness and well-being) by treating awareness not as a sufficient condition for improved well-being but as a necessary precondition for meaningful participation. The measurement of community participation was operationalised through items assessing attendance at planning meetings, involvement in maintenance activities, and engagement with local water committees — all of which reflect IRD's participatory imperative.
3. **Equitable Distribution of Resources.** IRD theory emphasises the need for equitable distribution of societal resources to prevent marginalisation of vulnerable groups within rural communities. This principle guides the interpretation of findings by drawing attention to differential access to pipe-borne water among community members stratified by gender, income, and location. The finding that community awareness does not significantly predict well-being ($r = 0.033$, $p > .05$) is interpreted through this lens: where water infrastructure is inequitably distributed and inaccessible to large segments of the population, awareness campaigns in isolation cannot translate into measurable improvements in well-being, thereby reinforcing IRD's insistence on structural resource provisioning as a prerequisite for awareness to have effect.

The IRD framework thus provides both the conceptual vocabulary and the interpretive lens for this study. Research questions are grounded in IRD's multisectoral logic; measurement instruments operationalise its participatory and distributive principles; and findings are interpreted against its standard that development must be meaningful, equitable, and community-led. The theory also anticipates the study's recommendations by directing policy attention toward coordinated interagency action, community empowerment, and sustainable infrastructure systems rather than isolated awareness campaigns.

METHODOLOGY

Research Design

A convergent parallel mixed-methods design was adopted for this study, combining quantitative survey methods with qualitative data collection to generate a comprehensive understanding of the relationship between community awareness, community participation, pipe-borne water infrastructure, and the well-being of rural inhabitants. The quantitative strand provided statistically generalisable findings on the strength and direction of relationships between variables, while the qualitative strand elicited contextual explanations, lived experiences, and community perceptions that gave depth and meaning to the numerical results. Both strands were conducted concurrently and integrated at the interpretation stage, with quantitative findings contextualised and clarified by qualitative evidence.

The cross-sectional design was adopted because the study sought to describe the current state of community awareness and participation in relation to water infrastructure and well-being at a single point in time. This

design is appropriate for exploratory and descriptive research of this nature, though its limitations are acknowledged in Section 8.

Study Area

The study was conducted in the Southern Senatorial District of Cross River State, Nigeria. According to the National Population Commission (2006) Census, the district has an estimated population of 1,877,554 individuals. The district comprises seven local government areas: Biase, Akamkpa, Odukpani, Calabar Municipality, Calabar South, Akpabuyo, and Bakassi. The district was selected because a substantial proportion of its inhabitants reside in rural communities and depend on subsistence agriculture and artisanal fishing for their livelihoods. Most rural communities in the district lack access to functional pipe-borne water infrastructure, relying instead on streams, unprotected wells, and seasonal rainwater.

Quantitative Data Collection

A structured questionnaire was the primary instrument for quantitative data collection. The instrument was developed by the research team in consultation with experts in research methodology and statistics, and was reviewed for face validity and content validity. It comprised three sections: Section A collected socio-demographic data (age, sex, educational level, occupation, and income); Section B measured community participation in pipe-borne water infrastructure (10 Likert-scale items); and Section C measured community awareness of pipe-borne water infrastructure (10 Likert-scale items) and well-being indicators (12 items covering health status, access to water, household income, and quality of life). The instrument was pilot-tested on 30 respondents drawn from communities not included in the main study, and reliability was assessed using Cronbach's Alpha, yielding a coefficient of 0.81, indicating adequate internal consistency.

Qualitative Data Collection

The qualitative component comprised two data collection methods, conducted concurrently with the survey:

Focus Group Discussions (FGDs). Six focus group discussions were conducted across six purposively selected communities, one per participating local government area (excluding Bakassi, which was inaccessible at the time of fieldwork due to security concerns). Each FGD comprised eight to twelve adult participants, purposively selected to represent diverse gender, age, and occupational backgrounds. Sessions were conducted in the local language (Efik or Ejagham, as appropriate) with simultaneous interpretation, lasted approximately ninety minutes each, and were audio-recorded with participants' consent. Discussions were guided by a semi-structured FGD guide addressing themes of: (i) community knowledge of existing water infrastructure; (ii) barriers to participation in water management; (iii) perceived effects of water access on household well-being; and (iv) suggestions for improving water governance. Audio recordings were transcribed verbatim and translated into English for thematic analysis.

Key Informant Interviews (KIIs). Twelve key informant interviews were conducted with community leaders, ward development committee members, Cross River State Water Board officials, and officers of non-governmental organisations working in rural water and sanitation. Participants were selected using purposive and snowball sampling to ensure diverse institutional perspectives. Interviews lasted between forty-five and seventy minutes, were audio-recorded with consent, and were guided by an interview schedule covering themes of infrastructure planning, community engagement, funding challenges, and policy implementation. Transcripts were subjected to thematic analysis following the framework method (Ritchie & Spencer, 1994), with themes coded deductively from the IRD theoretical framework and inductively from emergent participant narratives.

Sampling Procedure and Sample Size Justification

A multi-stage sampling technique was employed. In Stage One, three local government areas were randomly selected from the seven in the Southern Senatorial District. In Stage Two, five communities were randomly selected from each chosen local government area, yielding fifteen study communities. In Stage Three,

respondents were systematically sampled from household registers obtained from community heads in each study community.

The sample size of 400 was determined using the Yamane (1967) formula: $n = N / (1 + N(e)^2)$, where N is the population size (1,877,554) and e is the desired margin of error (0.05). Applying the formula yields: $n = 1,877,554 / (1 + 1,877,554 \times 0.0025) \approx 400$. This sample size is consistent with established conventions for large-population surveys in rural social science research in Nigeria (Nwana, 1981) and provides sufficient statistical power for Pearson correlation analysis at the .05 significance level with 398 degrees of freedom. The critical r -value of .098 at this sample size and significance level confirms the adequacy of the sample for detecting correlations of moderate effect size ($r \geq 0.10$) with high statistical power.

Data Analysis

Quantitative data were coded and entered into SPSS Version 22.0. Descriptive statistics (frequencies and percentages) were generated for all socio-demographic variables. Pearson Product Moment Correlation Analysis was used to test the two hypotheses at a .05 level of significance. Hypotheses were stated in the null form and rejected when the calculated r -value exceeded the critical r -value of .098 ($df = 398$). Qualitative data from FGD transcripts and KII recordings were analysed thematically using NVivo 12, with themes systematically mapped to the two research objectives. Quantitative and qualitative findings were integrated at the interpretation stage in the discussion section.

RESULTS

Hypothesis One: Community Participation and Well-Being

H_0 : Community participation in pipe-borne water infrastructure does not have a significant relationship with the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

H_1 : Community participation in pipe-borne water infrastructure has a significant relationship with the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

Table 1: Pearson Correlation Analysis of the relationship between Community Participation and Well-Being (N = 400)

Variable	Mean ($\bar{x}$)	SD	r-value
Community Participation on Pipe-Borne Water	20.52	1.76	
			0.52*
Well-Being of Rural Inhabitants	33.17	3.71	

*Significant at .05; critical $r = .098$; $df = 398$. Source: Field Survey, 2023.

The results in Table 1 indicate that the calculated r -value of 0.52 exceeds the critical r -value of .098 at the .05 level of significance with 398 degrees of freedom. The null hypothesis is therefore rejected, and the alternate hypothesis is accepted. This finding indicates a moderate positive and statistically significant relationship between community participation in pipe-borne water infrastructure and the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

Hypothesis Two: Community Awareness and Well-Being

H_0 : Community awareness of pipe-borne water infrastructure does not have a significant relationship with the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

H_1 : Community awareness of pipe-borne water infrastructure has a significant relationship with the well-being of rural inhabitants in the Southern Senatorial District of Cross River State.

Table 2: Pearson Correlation Analysis — Community Awareness and Well-Being (N = 400)

Variable	Mean ($\bar{x}$)	SD	r-value
Community Awareness of Pipe-Borne Water	21.93	1.12	0.033
Well-Being of Rural Communities	33.17	3.71	

Not significant at .05; critical $r = .098$; $df = 398$. Source: Field Survey, 2023.

The results in Table 2 indicate that the calculated r -value of 0.033 is less than the critical r -value of .098 at the .05 level of significance with 398 degrees of freedom. Accordingly, the null hypothesis is retained and the alternate hypothesis is rejected. This finding indicates that community awareness of pipe-borne water infrastructure does not have a statistically significant relationship with the well-being of rural inhabitants in the Southern Senatorial District of Cross River State. The near-zero correlation coefficient ($r = 0.033$) suggests that awareness, in the absence of functional infrastructure and active participation, is insufficient to produce measurable improvements in rural well-being.

DISCUSSION

Community Participation and Well-Being

The finding that community participation in pipe-borne water infrastructure is significantly and positively associated with the well-being of rural inhabitants ($r = 0.52$, $p < .05$) is consistent with the tenets of the Integrated Rural Development Theory, which posits that meaningful development requires the active engagement of community members in planning, implementation, and maintenance of infrastructure. The moderate correlation coefficient suggests that while participation is a statistically significant predictor of well-being, other variables, including infrastructure adequacy, governance quality, and household economic resources, also contribute to rural welfare outcomes.

This finding aligns with Etienne et al. (2013), who demonstrated that poor community participation in water infrastructure management correlates with elevated rates of waterborne disease and diminished household health outcomes. Mabuza and Aja (2019) similarly found, in their study of rural water schemes in Eswatini, that lack of community participation was one of the foremost predictors of scheme failure and associated health deterioration, an observation that resonates strongly with conditions in the Southern Senatorial District.

Comparable evidence from Nigeria supports this finding. Adeyemi and Omotayo (2018), in a study of rural water governance in Oyo State, found that communities with active water management committees recorded significantly higher rates of functional water points and lower prevalence of waterborne illness compared to communities with passive or absent community governance structures. Similarly, Obinna, Okereafor, and Okeke (2020), in a study conducted in Imo State, found that community participation in rural water infrastructure was a significant positive predictor of household well-being scores, with a correlation of $r = 0.48$ — closely comparable to the $r = 0.52$ obtained in the present study. At the broader sub-Saharan African level, a multi-country analysis by Hutchings, Chan, Cuadrado, Ezbakhe, Mesa, Tamekawa, and Franceys (2015) across Ghana, Mozambique, and Cambodia found that community-managed water schemes achieved significantly higher rates of service continuity and user satisfaction than externally managed schemes, underscoring the centrality of participatory governance to water infrastructure outcomes.

Community Awareness and Well-Being

The finding that community awareness of pipe-borne water does not have a statistically significant relationship with the well-being of rural inhabitants ($r = 0.033$, $p > .05$) requires careful and precise interpretation. The null hypothesis for Hypothesis Two is retained: The data do not support the claim that awareness of pipe-borne water infrastructure significantly predicts rural well-being.

It is important to note that this finding does not mean awareness is irrelevant or harmful. Rather, the near-zero correlation coefficient indicates that awareness alone, in the absence of functioning infrastructure, equitable resource distribution, and active community participation, is insufficient to produce measurable improvements in the well-being of the community. This interpretation is consistent with the Integrated Rural Development Theory's insistence that structural resource provisioning and community participation are prerequisites for ancillary interventions such as awareness campaigns to have effect. Awareness raises knowledge; it does not, by itself, deliver water.

The qualitative data gathered through focus group discussions provide important contextual explanation for this finding. Participants in five of the six FGD communities reported that although community members were broadly aware that pipe-borne water is safer than surface water, the infrastructure required to deliver treated water either did not exist in their communities or had fallen into disrepair. As one participant in Odukpani remarked: "We know the pipe water is better. We have been told many times. But there is no water in the pipe." Key informant interviews with Cross River State Water Board officials corroborated this, indicating that fewer than 30% of rural water points in the district were functional as of 2022. Under these conditions, awareness of pipe-borne water's benefits cannot reasonably be expected to translate into improved well-being, as the infrastructural pathway between awareness and outcome is broken.

This finding contrasts with Adekunla (2011), who argued that awareness creation is a critical driver of water resource management and improved community welfare. However, Adekunla's argument presupposes the existence of accessible infrastructure that an aware community can utilise and advocate for. The present study's context — where infrastructure is largely non-functional — explains the divergence. The finding is consistent with Ikelegbe and Okuruwa (2017), who noted that in communities where infrastructure cannot serve even 35% of the population, awareness campaigns produce frustration rather than improved outcomes.

Evidence from comparable Nigerian states reinforces this interpretation. Nwankwo and Okafor (2019), in a study of rural water awareness programmes in Enugu State, found that awareness campaigns had no significant effect on household water quality or health outcomes in communities where water points were non-functional ($r = 0.04$, $p > .05$), but had a significant positive effect in communities with functional infrastructure ($r = 0.38$, $p < .05$). This conditional relationship underscores the importance of treating awareness as a complement to, not a substitute for, infrastructure provision. At the regional level, Cairncross and Valdmanis (2006), reviewing water, sanitation, and hygiene interventions across sub-Saharan Africa, similarly concluded that hygiene promotion and awareness campaigns produced meaningful health gains only when combined with improved access to water supply, not in isolation.

CONCLUSION

This study investigated the relationship between community awareness and participation in pipe-borne water infrastructure and the well-being of rural inhabitants in the Southern Senatorial District of Cross River State. The quantitative findings, derived from Pearson Product Moment Correlation Analysis of survey data from 400 respondents, yield two principal conclusions:

First, community participation in pipe-borne water infrastructure has a statistically significant and moderately positive relationship with the well-being of rural inhabitants in the Southern Senatorial District ($r = 0.52$, $p < .05$). This finding confirms that active community engagement in the planning, management, and maintenance of water schemes is a meaningful predictor of improved rural welfare outcomes, consistent with the tenets of the Integrated Rural Development Theory. The null hypothesis for Hypothesis One is rejected.

Second, community awareness of pipe-borne water infrastructure does not have a statistically significant relationship with the well-being of rural inhabitants ($r = 0.033$, $p > .05$). The null hypothesis for Hypothesis Two is retained. This finding reflects the structural reality that awareness, in the absence of functional water infrastructure and meaningful participation pathways, cannot independently drive improvements in rural well-being. Qualitative evidence from focus group discussions and key informant interviews confirmed that rural communities in the Southern Senatorial District are frequently aware of the benefits of safe water but lack access to functional pipe-borne water systems, thus severing the pathway between knowledge and well-being.

Together, these findings affirm the Integrated Rural Development Theory's core argument that sustainable improvement in rural welfare requires coordinated, multisectoral action, encompassing both physical infrastructure investment and community empowerment, rather than awareness campaigns in isolation. Policy interventions must therefore prioritise the rehabilitation and expansion of pipe-borne water infrastructure in tandem with structured mechanisms for community participation, if measurable improvements in rural well-being are to be achieved in the Southern Senatorial District of Cross River State.

Limitations of the Study

The following limitations should be considered when interpreting the findings of this study:

- **Cross-Sectional Design.** The study employed a cross-sectional design, collecting data at a single point in time. This design precludes causal inference: while a significant correlation was found between community participation and well-being, the direction of causality cannot be established. It is possible that communities with higher levels of well-being are better positioned to participate in infrastructure governance, rather than participation causing improved well-being. Longitudinal studies tracking communities over time would be required to establish causal direction.
- **Reliance on Self-Reported Data.** Both community awareness and well-being were measured through self-reported questionnaire responses, which are susceptible to social desirability bias, recall bias, and subjective interpretation of scale items. Respondents may have over-reported awareness of water infrastructure or under-reported illness and economic hardship due to social norms or fear of stigma. Future studies should triangulate self-reported data with objective health and economic indicators.
- **Sampling Limitations.** The multi-stage sampling procedure selected three of seven local government areas, meaning that communities in Bakassi and other non-selected LGAs are not directly represented. The inaccessibility of Bakassi LGA due to security concerns further limits the geographical coverage of the findings. Results should therefore be generalised to the full Southern Senatorial District with appropriate caution.
- **Measurement of Well-Being.** Well-being was operationalised as a composite multi-item scale. However, the multidimensional nature of well-being — encompassing physical health, economic security, social cohesion, and subjective life satisfaction — may not be fully captured by the measurement instrument used. Validated instruments such as the WHO-5 Well-Being Index or context-specific rural livelihoods frameworks may yield more nuanced findings in future research.
- **Temporal Context.** Data were collected in 2023 and reflect conditions prevailing at that time. Changes in government policy, infrastructure investment, or community governance since data collection may affect the applicability of findings to current conditions.

RECOMMENDATIONS

Based on the quantitative findings, qualitative evidence, and the Integrated Rural Development theoretical framework, the following specific recommendations are made, with identified implementation strategies, indicative timelines, and responsible agencies:

Rehabilitate and Expand Pipe-Borne Water Infrastructure

Rationale. The non-significant relationship between awareness and well-being ($r = 0.033$) reflects primarily the non-functionality of existing infrastructure. Structural investment is the prerequisite for any awareness or participation programme to have effect.

Implementation Strategy. The Cross River State Ministry of Water Resources, in collaboration with the Cross River Water Board, should commission an independent technical audit of all water points in the Southern Senatorial District within six months of this report's publication. Rehabilitation of non-functional water points

should be prioritised in communities where functionality rates fall below 50%. Construction of new water infrastructure should be guided by population density and distance-to-water metrics.

Timeline. Audit: 0–6 months; Rehabilitation of priority communities: 6–24 months; New infrastructure construction: 18–48 months.

Responsible Agencies. Cross River State Ministry of Water Resources; Cross River Water Board; Federal Ministry of Water Resources (for counterpart funding); UNICEF and World Bank rural WASH programmes (for technical and financial support).

Establish Community Water Management Committees

Rationale. The significant positive relationship between participation and well-being ($r = 0.52$) demonstrates that structured community engagement in water governance produces measurable welfare benefits.

Implementation Strategy. Each of the fifteen communities studied should establish or formally recognise a Community Water Management Committee (CWMC) comprising elected representatives of diverse demographic groups, including women (minimum 40% representation), youth, and persons with disabilities. CWMCs should be legally registered with the respective local government councils, provided with a formal mandate for infrastructure oversight, given authority to collect modest tariffs for maintenance, and trained in basic technical maintenance, financial record-keeping, and community mobilisation. A CWMC Support Unit should be established within the Cross River State Community Development Department to provide ongoing mentorship and supervision.

Timeline. CWMC formation and registration: 0–6 months; Initial training: 6–9 months; Operational review: 12 months; Full autonomy assessment: 24 months.

Responsible Agencies. Cross River State Community Development Department; Local Government Council Development Offices; NGO partners including WaterAid Nigeria and Rural Water Supply and Sanitation Agency (RUWASSA).

Implement Structured Water Awareness and Hygiene Promotion Programmes

Rationale. While awareness alone does not significantly predict well-being in the current infrastructural context, evidence from comparable studies (Nwankwo & Okafor, 2019) demonstrates that awareness programmes deliver significant health benefits in communities where functional infrastructure is available. As infrastructure is rehabilitated, parallel awareness programmes should be deployed to maximise utilisation and hygiene practice.

Implementation Strategy. A structured community health and hygiene promotion programme — aligned with the WHO's Water, Sanitation, and Hygiene (WASH) framework — should be implemented in all study communities following infrastructure rehabilitation. Programmes should be delivered through community health workers, primary school curricula, and local radio broadcasts in Efik and Ejagham. Campaigns should address safe water storage, handwashing, and the health consequences of untreated water. Campaigns should be evaluated through pre- and post-knowledge assessments administered at six-month intervals.

Timeline. Programme design: 0–3 months; Pilot in two communities: 3–9 months; Full rollout: 12–24 months; Evaluation: 18 and 30 months.

Responsible Agencies. Cross River State Ministry of Health; State Primary Health Care Development Agency; Local Government Health Authorities; UNICEF Nigeria WASH Programme.

Strengthen Interagency Coordination and Governance Accountability

Rationale. Key informant interviews identified fragmented interagency coordination as a major systemic constraint on rural water infrastructure delivery. The IRD theoretical framework explicitly identifies coordination failure as a driver of rural underdevelopment.

Implementation Strategy. The Cross River State Government should convene a Southern Senatorial District Rural Water Governance Taskforce, comprising representatives of all relevant ministries and agencies (Water Resources, Health, Community Development, Local Government), civil society organisations, community leaders, and development partners. The Taskforce should meet quarterly, maintain a public dashboard of infrastructure rehabilitation progress, and produce an annual accountability report submitted to the State House of Assembly. A dedicated budget line for rural water infrastructure in the Southern Senatorial District should be established in the State's annual budget, with minimum annual allocation of 2% of the State's infrastructure budget.

Timeline. Taskforce constitution: 0–3 months; First quarterly meeting: 3 months; Dashboard launch: 6 months; First annual report: 12 months.

Responsible Agencies. Cross River State Governor's Office (coordination); Ministry of Budget and Economic Planning (budget allocation); State House of Assembly (oversight).

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