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Impact of Institutional Governance on Household Water Security in Selected Communities of Bauchi Local Government Area, Nigeria

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Abstract

Although formal institutions are mandated to provide domestic water services, persistent water insecurity remains a major challenge in peri-urban communities of Bauchi State, Nigeria. This study investigated the institutional arrangements governing domestic water supply and evaluated household water security in four peri-urban communities—Bayara, Lushi, Gudun Sayawa, and Gwallagan Mayaka—within Bauchi Local Government Area. An explanatory mixed-methods research design was employed, integrating quantitative data from a structured household survey of 401 respondents with qualitative insights obtained through key informant interviews involving officials of the Bauchi State Water Supply Corporation (BSWSC) and the Rural Water Supply and Sanitation Agency (RUWASSA). Household water security was assessed using the validated Household Water Insecurity Experiences (HWISE) scale (Cronbach's $\alpha = 0.83$) and subsequently operationalized into a composite Household Water Security Index (HWS). Results revealed that community-managed boreholes and hand-dug wells constituted the dominant sources of domestic water, serving 85.3% of households, whereas BSWSC piped-water connections accounted for only 9.2% of access. The overall mean HWS score was 22.47 ± 4.83 , indicating moderate-to-high levels of water insecurity across the study area. Spatial variations were evident, with Gudun Sayawa exhibiting the highest level of insecurity ($M = 25.31$), while Bayara recorded the lowest ($M = 19.82$). Seasonal vulnerability was pronounced, as 88.7% of households reported severe or moderate impacts during drought periods. Households spent an average of 1.74 hours daily collecting water, increasing to 2.14 hours in Gudun Sayawa. Institutional analysis revealed overlapping mandates between BSWSC and RUWASSA, compounded by the absence of formal coordination mechanisms, resulting in fragmented service delivery and limited operational effectiveness. The study concludes that household water insecurity is primarily a governance challenge driven by institutional fragmentation rather than institutional absence. Strengthening inter-agency coordination and prioritizing targeted infrastructure investments are therefore critical for enhancing water security and accelerating progress toward Sustainable Development Goal 6.

Keywords

Bauchi State;
Household Water Security;
Institutional Governance;
Water Insecurity Index;
Water Supply Agencies

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INTRODUCTION

Access to safe, affordable, and reliable domestic water remains a major development challenge in Sub-Saharan Africa, shaped by population growth and weak governance (Paiva et al., 2020). Water governance is central to SDG 6, and the OECD Principles highlight accountability, coordination, transparency, and participation as key requirements for sustainable management (OECD, 2015; UN-Water, 2018).

In practice, many institutions fall short of these standards, so urban and peri-urban water crises are increasingly understood as governance failures rather than technical ones (Hassenforder & Barone, 2018; Franco-Torres et al., 2021). Household water security the reliable ability to access sufficient, safe, affordable, and acceptable water is therefore a direct indicator of whether governance systems are working (Jepson et al., 2017).

Nigeria's water sector remains fragmented across federal, state, and local levels (Isukuru et al., 2024; Fadeyi et al., 2025;). In Bauchi State, BSWSC and RUWASSA hold the main water supply mandates, but they operate across overlapping domains without a formal coordination framework (Ndububa, 2021; Igboaruka, 2025;). In Bayara, Lushi, Gudun Sayawa, and Gwallagan Mayaka, households still rely heavily on informal sources despite the presence of these institutions. Previous studies in Bauchi link unequal water access to infrastructure and accountability gaps rather than absolute scarcity (Istifanus, 2017; Istifanus & Bwala, 2019; Ndububa, 2021).

There is still limited empirical evidence that connects water governance structures directly to household water security outcomes using standardised measures. This study addresses

that gap by examining the institutional and policy frameworks governing domestic water supply and assessing household water security across the four communities.

MATERIALS AND METHODS

Study Area and Research Design

The study was conducted in Bayara, Lushi, Gudun Sayawa, and Gwallagan Mayaka — four communities in Bauchi Local Government Area purposively selected for variation in settlement density, pipeline proximity, and informal water source reliance. The area has a semi-arid climate with mean annual rainfall of 900–1,100 mm and a prolonged dry season from October to April (NiMet, 2023). An explanatory mixed-methods design integrated quantitative household survey data with qualitative Key Informant Interview (KII) evidence to establish and explain patterns of household water security and institutional perception.

Sample size was determined using Cochran's (1977) formula, applied in comparable north-eastern Nigerian contexts including Salisu and Ayuba (2025) who used identical parameters to derive 384 households:

$$n = (Z^2 \times p \times q) / e^2 \quad (1)$$

where $Z = 1.96$ (95% confidence level); $p = 0.5$ (assumed proportion); $q = 1 - p = 0.5$; $e = 0.05$ (margin of error).

This yielded 385, adjusted to 400 households (100 per community) to accommodate non-response; 401 usable questionnaires were retrieved (response rate 100.3%). Households were selected by systematic random sampling from community residential registers following purposive community selection. KIIs were conducted with senior officials of BSWSC, RUWASSA, and the Bauchi State Ministry of

Water Resources, selected for direct involvement in water governance.

The household questionnaire measured water insecurity using the ten-item HWISE scale (Young et al., 2019; Miller et al., 2020), aggregated as:

$$HWS = \sum X_i (2)$$

where X_i represents each HWISE indicator ($i = 1$ to 10); higher scores indicate greater insecurity. The composite demonstrated acceptable internal consistency

(Cronbach's $\alpha = 0.83$). KIIs explored agency mandates, coordination arrangements, financing, and service delivery constraints.

Method of Data Analysis

Quantitative analysis was performed using IBM SPSS Statistics 26.0 to generate descriptive statistics, a method consistent with recent regional research (Salisu and Ayuba, 2025; Magaji and Ismail, 2025). Qualitative KII data underwent thematic Framework Analysis (Ritchie and Spencer, 1994). Themes were developed deductively from OECD Principles on Water Governance (Jiménez, Saikia, Giné, Avello, Leten, Lymer, Schneider and Ward, 2020; Fadeyi, Bessah and Ololade, 2025) and inductively from the data. Integration occurred at the interpretation stage following an explanatory sequential mixed-methods design (Creswell and Plano Clark, 2023).

RESULTS AND DISCUSSION

Sociodemographic Characteristics of Respondents

A total of 401 questionnaires were retrieved and found usable, distributed near-equally across the four communities (24.9–25.2% each). Male-headed households constituted 61.8% of the sample and female-headed households 38.2%, and 84.3% had attained at least secondary-level education, supporting the reliability of self-reported data.

Institutional and Policy Frameworks Governing Domestic Water Supply

Examination of the institutional architecture confirmed overlapping statutory mandates: BSWSC covers urban and peri-urban piped supply and sewage management while RUWASSA extends to rural water supply and sanitation. KIIs revealed that both agencies operate in the same communities without shared planning frameworks, joint monitoring mechanisms, or formally delineated responsibilities. Officials from both independently identified this as a structural constraint, BSWSC respondents cited ageing infrastructure, unreliable electricity, and insufficient maintenance budgets; RUWASSA respondents cited rehabilitation costs and volatile budget releases. Table 1 summarizes the comparative institutional characteristics confirmed through KIIs.

Table 1: Comparative Institutional Mandates of BSWSC and RUWASSA

Attribute	BSWSC	RUWASSA
Statutory mandate	Urban and peri-urban piped water supply; sewage management	Rural water supply and sanitation
Primary infrastructure	Piped networks, treatment plants, pumping stations	Community boreholes, hand-dug wells
Coverage in study area	9.2% of households (pipeline)	Supports borehole infrastructure; not pipeline-based

Reported constraints (KII)	Ageing infrastructure; unreliable electricity; inadequate maintenance budget	Borehole rehabilitation costs; volatile budget releases
Coordination mechanism	None formally established	None formally established

Source: Key Informant Interviews and Field Survey, 2026.

This is consistent with Igboaruka's (2025) finding that weak inter-agency collaboration constrains WASH governance in Bauchi State, and supports Franco-Torres et al.'s (2021) argument that urban water governance often involves competing rationalities never fully reconciled through formal design.

Household Water Security: Sufficiency and Reliability

Table 2 presents the distribution of primary drinking water sources.

Table 2: Primary Source of Drinking Water

Water Source	Frequency	Percent (%)
Community borehole	178	44.4
Hand-dug well	164	40.9
BSWSC pipeline	37	9.2
Water tanker	17	4.2
Other sources	5	1.3
Total	401	100.0

Source: Field Survey, 2026.

Community boreholes (44.4%) and hand-dug wells (40.9%) together accounted for 85.3% of primary sources, while formal BSWSC piped supply reached only 9.2%. This corroborates Ndububa (2021), who identified groundwater as the baseline for domestic supply in Bauchi State and cautioned that non-functional public facilities threaten SDG 6 progress. The dominance of household-managed sources over

formal infrastructure indicates that institutional supply, where it reaches households at all, is not the primary basis for domestic water security in the study communities.

Household water security was assessed using the composite HWS index, with community-level disaggregation in Table 3.

Table 3: Household Water Security Index (HWS) by Community

Community	n	Mean HWS	SD	% Borehole/Well
Bayara	100	19.82	4.21	78.0
Lushi	100	21.64	4.54	83.0
Gudun Sayawa	100	25.31	4.93	94.0
Gwallagan Mayaka	101	23.18	4.72	87.1
Overall sample	401	22.47	4.83	85.3

Source: SPSS Version 26.0 Output; Field Survey, 2026. Higher HWS scores indicate greater water insecurity.

The overall HWS mean of 22.47 (SD = 4.83) indicates moderate-to-high insecurity. Gudun Sayawa recorded the highest insecurity (M = 25.31), corresponding with its lowest pipeline coverage and highest borehole/well reliance (94.0%); Bayara recorded the lowest (M = 19.82). This 5.49-point gap between two communities under the same institutional mandates demonstrates that spatial inequality in institutional reach translates directly into

measurable differences in household water security.

Reliability was further examined through household-reported experiences during climate-related stress, summarized in Table 4: 65.3% of households reported water becoming very scarce, and 23.4% reported quality deterioration, a combined impact rate of 88.7%.

Table 4: Effects of Climate-Related Stress on Household Water Access

Reported Effect	Frequency	Percent (%)
Water becomes very scarce	262	65.3
Quality worsens significantly	94	23.4
No noticeable change	35	8.7
Water becomes more expensive	5	1.2
Completely unavailable	5	1.2
Total	401	100.0

Source: Field Survey, 2026.

This reliability deficit is reinforced by the time burden of water collection, averaging 1.74 hours daily across the sample and rising to 2.14 hours in Gudun Sayawa. KIIs linked this gap to the constraints in Table 1: deferred maintenance from inadequate, unpredictable budget releases directly produces the supply interruptions households experience as unreliability.

Household Water Security: Affordability and Quality

A combined 67.4% of respondents disagreed or strongly disagreed that BSWSC provides reliable supply, against 53.1% for RUWASSA, consistent with the institutional admissions recorded during KIIs. Affordability concerns were most evident in reliance on vendors and tankers (11.4% combined), at costs exceeding nominal tariffs for piped supply or supported boreholes. Hand-dug wells (40.9%) carry additional quality risk, being most susceptible to rainy-season contamination and subject to no routine institutional monitoring.

Together, the four dimensions point to a single pattern: institutional water supply, where it reaches households at all, is not extensive or consistent enough to constitute the primary basis for domestic water security in the study communities. The 85.3% dependence on boreholes and wells is a measurable outcome of limited institutional reach, not principally household preference.

Linking Institutional Frameworks to Household Outcomes

The absence of a coordination mechanism between BSWSC and RUWASSA, combined with chronic underfunding acknowledged by both agencies, restricts the expansion and maintenance of piped infrastructure. This gap is filled, at the household level, by sources that are less reliable, more time-intensive, and more exposed to quality risk than the systems they are meant to complement. The spatial correspondence between weak institutional coverage and elevated insecurity, most pronounced in Gudun Sayawa, supports the proposition that household water insecurity is shaped by institutional and policy implementation gaps rather than the absence

of governing frameworks. These findings extend Hassenforder and Barone's (2018) argument that governance failures emerge where institutions fail to align with local realities, and confirm Miller et al. (2020) finding linking governance quality to household water insecurity.

CONCLUSION AND RECOMMENDATION

This study examined the institutional and policy frameworks governing domestic water supply and assessed household water security across four communities in Bauchi Local Government Area. BSWSC and RUWASSA hold clear statutory mandates, but operational coordination between them is informal and largely absent, contributing to fragmented service delivery. Household water security, measured through the validated HWISE-derived composite index, was moderate to high in insecurity, with spatial variation corresponding to differences in institutional coverage. Community boreholes and hand-dug wells, rather than formal piped infrastructure, constitute the primary water source for most households, with direct implications for reliability, affordability, and quality.

A gap remains in understanding how formal inter-agency coordination, or its absence, translates into household outcomes over time, an area for longitudinal monitoring. It is recommended that the Bauchi State Government establish a formal coordination mechanism between BSWSC and RUWASSA with jointly monitored service area responsibilities, secure dedicated maintenance financing for both agencies, and prioritise infrastructure investment in communities with the weakest institutional coverage, such as Gudun Sayawa, to advance progress toward SDG 6.

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**State: Lessons from Misau LGA,
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