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Policy Analysis of Water Resource Management and its Implication for Environmental Sustainability in Katsina State, Nigeria

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Abstract **Case Studies**

This study investigated water resource management in Katsina State, Nigeria, a semi-arid region facing intertwined environmental, public health, and socioeconomic challenges. Utilizing a mixed-methods approach, the research combined quantitative survey data from 520 households across 12 Local Government Areas (LGAs) with qualitative insights from 18 key informants and 8 focus groups. The survey revealed a strong reliance on groundwater, with 67.3% of households using boreholes or wells. However, this dependence is marred by frequent water shortages (58.7%), perceived water unsafety (62.1%), and a high incidence of waterborne diseases (43.2%). Women and children bear the brunt of water collection, traveling an average of 1.8 km. Awareness of water policies, such as the SURWASH program, was notably low. Qualitative data underscored governance issues like fragmented institutions, weak enforcement, and limited community involvement. Focus groups identified a lack of effective grievance mechanisms and accountability among water committees. Environmentally, while many LGAs are Open Defecation Free (ODF), groundwater contamination is a concern due to inadequate separation between wells and latrines (average 11.4 meters), indicating a gap between policy and practice. The study concludes that despite policy reforms in Katsina State, significant implementation deficits persist, affecting regulatory enforcement, inter-institutional coordination, and community participation. To enhance environmental sustainability, it is recommended to strengthen the regulatory capacity of SEPA, enforce stricter standards for well and latrine separation, establish robust community feedback systems, and integrate climate resilience into water sector planning. The effectiveness of water policies is contingent on implementation structures and genuine community engagement.

Keywords: Water Policy Analysis, Environmental Sustainability, Water Resource Management, Water Quality, Public Health.

1. Introduction

1.1 Background of the Study

Water resource management is fundamental to achieving environmental sustainability and the Sustainable Development Goals (SDGs). While SDG 6 aims for universal access to clean water and sanitation, progress in sub-Saharan Africa lags behind the 2030 target (Sani and Scholz, 2021). Nigeria, with its vast population, faces significant hurdles, as millions are deprived of safe drinking water and basic sanitation (Julius et, al., 2025; Victor et al., 2025; Sani and Scholz, 2021).

The decentralized nature of water management in Nigeria, stemming from its constitutional framework, has led to considerable disparities in governance, institutional structures, and environmental results across states. Northern

states, particularly those in semi-arid regions like Katsina, contend with severe water scarcity (Adegboyega et al, 2021; Inkani et, al., 2015). These areas experience low annual rainfall, high evapotranspiration rates, and significant groundwater contamination from natural elements like fluoride and human-induced pollutants such as heavy metals and microbes (Abubakar, et al., 2018; Kankara et, al., 2018). Compounding these issues is the increasing unpredictability of climate patterns.

Katsina State, situated in Nigeria's northwestern Sahelian belt, covers an area of roughly 24,192 km². It is home to over 9 million people, the majority of whom live in rural settings and rely on agriculture (Bishir et, al, 2018) . An overwhelming 85% of the population depends on groundwater for both daily needs and farming. The state's water supply comes from both surface sources, like the Zobe, Ajiwa, and Sabke dams, and groundwater drawn from the underlying Basement Complex and sedimentary aquifers.

1.2 Statement of the Problem

Despite considerable financial commitments to water supply infrastructure, such as the SURWASH program, solar-powered boreholes, and the Zobe Dam rehabilitation, achieving environmental sustainability in water resource management remains a challenge. The lack of a unified and integrated approach has led to disjointed projects, overlapping initiatives, and insufficient focus on critical environmental aspects like groundwater depletion, pollution mitigation, ecosystem preservation, and climate resilience.

The outdated 1971 Water Board Edict, which previously governed the sector for over fifty years, has been repealed due to its inadequacy in addressing current issues. Although recent policy reforms are both opportune and essential, their specific content, execution strategies, and environmental impacts warrant thorough examination. Furthermore, the perspectives of those who directly utilize water resources have been largely overlooked in policy discussions. This research aims to fill this void by incorporating primary data collected from households, community members, and relevant institutional stakeholders.

1.3 Research Questions

This research investigated several key questions concerning water resource management in Katsina State.

i. What is the current policy and institutional framework for water resource management in Katsina State and stakeholder experiences with its implementation?
ii. What are the implementation gaps, coordination failures, and regulatory weaknesses as perceived by water users and sector professionals?
iii. What are the environmental implications of existing water management practices, including groundwater depletion, pollution, and ecosystem degradation?
iv. How can strategies for policy reform and institutional strengthening contribute towards achieving environmental sustainability from a multi-stakeholder perspective?

1.4 Significance of the Study

This research enhances the existing body of knowledge on water governance within semi-arid regions by presenting original empirical data on the disparity between policy and practice in Katsina State. Employing a mixed-methods approach, the study integrates an analysis of macro-level institutional dynamics with micro-level lived experiences of water users. The findings offer practical insights directly applicable to policymakers, development partners, and civil society organizations.

2. Literature Review

2.1 Theoretical Framework: Environmental Governance and Policy Implementation

This study draws theoretical grounding from Pressman and Wildavsky's (1973) policy implementation theory, which attributes discrepancies between policy formulation and actual results to institutional fragmentation, communication breakdowns, and limitations in resources. Additionally, it incorporates the Integrated Water Resource Management (IWRM) framework, advocated by the Global

Water Partnership, offering a model for comprehensive water management that seeks to balance social equity, economic efficiency, and environmental sustainability. The research also acknowledges the growing importance of the water–energy–food nexus approach in comprehending the interconnectedness of water policies and wider development objectives, particularly in semi-arid regions. These theoretical frameworks are empirically applied within this study through an examination of policy tools, institutional structures, and outcomes at the community level.

2.2 Water Governance in Nigeria: Constitutional and Policy Context

In Nigeria, water resource governance is structured by a constitution that assigns the primary responsibility for water supply to state governments. The federal government, however, holds jurisdiction over water sources impacting multiple states, as stipulated in Item 64 of the Exclusive Legislative List. This division has led to a fragmented governance system, where individual states establish their own regulations, institutions, and investment strategies, often with minimal coordination.

A National Water Resources Policy, approved in September 2016, was intended to promote sustainable access to safe water and preserve freshwater ecosystems. Nevertheless, its implementation has been inconsistent, with states largely maintaining control over water services. A proposed National Water Resources Bill, designed to consolidate various water sector laws, has faced significant political opposition, culminating in its rejection by the Senate in June 2023.

2.3 Katsina State Water Policy's Evolution

Before Governor Dikko Radda's administration began its reforms in 2023, water governance in Katsina State was guided by the Water Board Edict of 1971. This edict, initially created for the former Kaduna State and later modified in 1987 for Katsina State, primarily addressed urban water supply through the State Water Board. It offered minimal provisions for rural water supply, coordination of sanitation efforts, environmental preservation, or regulatory supervision.

In May 2025, Governor Radda initiated a review and update of the outdated Water Board Edict. This effort aims to bring Katsina State's water governance in line with international standards, thereby enhancing efficiency, accountability, and long-term sustainability within the sector. A major initiative in Katsina State's water sector is the SURWASH program, a World Bank-supported project valued at US$700 million, which has seen over N25 billion in projects reach various stages of completion.

2.4 Environmental Sustainability Challenges in Katsina State

Past research has highlighted serious water quality issues in Katsina State. For instance, studies by Odewade et al., in 2025 revealed that in Funtua, wells were situated too close to pit latrines, at an average distance of just 11.4 meters compared to the World Health Organization's recommended 30 meters. These wells also showed high levels of coliform bacteria and the presence of harmful microbes like *Escherichia coli*, *Shigella dysenteriae*, and *Salmonella typhi*.

Further research by Abdulbasid et al., (2026) on groundwater in Dutsin Ma found that all tested samples surpassed WHO guidelines for turbidity, lead, and cadmium. Microbial contamination was also identified in two out of three locations. Additionally, Ruma (2023) reported lead levels in urban well water ranging from 0.08 to 0.09 mg/L, exceeding WHO standards, while Garba et al., (2023) detected cadmium contamination in boreholes across Katsina metropolis. These findings collectively indicate that groundwater pollution, stemming from both natural geological sources and human activities, is a widespread problem, despite water quality monitoring being infrequent.

2.5 Gap in Literature

The current literature on water resource management in Katsina State is largely characterized by its reliance on secondary data

sources, which inherently limits the integration of direct perspectives from key stakeholders. While empirical data derived from water quality assessments is available, there is a notable absence of studies that systematically delve into the practical challenges of policy implementation, the intricacies of institutional coordination, and the lived experiences at the community level that ultimately influence environmental conditions. This research is specifically designed to address these omissions. Employing a mixed-methods research design, the study prioritizes the voices and experiences of water users and institutional actors, aiming to generate a more nuanced and complete understanding of the subject.

3. Methodology

3.1 Research Design

This investigation utilized a convergent parallel mixed-methods approach, wherein quantitative and qualitative data were concurrently gathered. Subsequent to independent analysis of each data type, the resultant findings were synthesized during the interpretation phase. The rationale for adopting this design was to comprehensively ascertain the breadth of household-level experiences, as captured through survey instruments, while simultaneously exploring the depth of institutional and community viewpoints, elucidated via interviews and focus group discussions.

3.2 Study Area

3.2.1 Sampling Technique

3.2.2 Household Sample Survey: A stratified random sampling methodology was implemented for this study. The 12 Local Government Areas (LGAs) were first divided into three distinct strata: urban, semi-urban, and rural (as presented in figure 1). Subsequently, households within each stratum were randomly selected using a systematic approach, involving the selection of every tenth household. The requisite sample size was calculated utilizing Yamane's formula (1967), aiming for a 95% confidence level and a 5% margin of error, which resulted in a target of at least 400 households. To mitigate potential non-response and data incompleteness, a total of 520 questionnaires were administered. Of these, 487 were successfully returned and deemed valid, achieving a response rate of 93.7%.

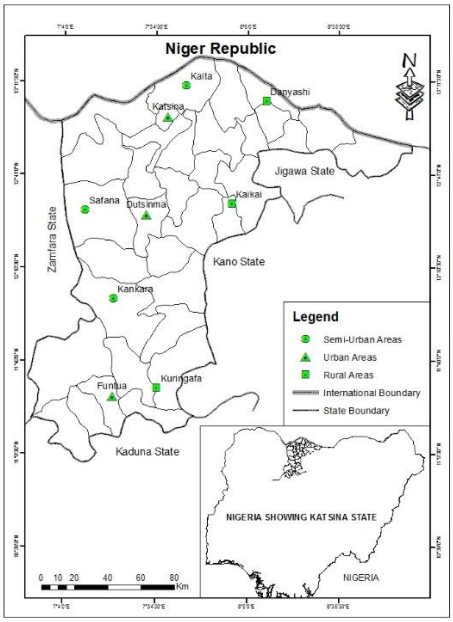

Figure 1.: Map of the study area showing sampled communities

3.2.3 Key Informant Sample: For the qualitative component of this research, a deliberate selection of eighteen key informants was undertaken. This purposive sampling strategy ensured representation from critical stakeholder groups involved in water resource management and WASH initiatives within the study area. Specifically, participants were drawn from the State Ministry of Water Resources (n=3), the Katsina State Water Board (n=2), RUWASSA (n=2), STWSSHA (n=2), SEPA (n=2), the World Bank SURWASH Project Coordination Unit (n=2), UNICEF WASH programme staff (n=2), academic researchers in hydrogeology (n=2), and a representative from a civil society organization engaged in WASH activities (n=1).

3.3.4 Focus Group Discussions: A total of eight focus group discussions (FGDs) were conducted, with each session involving between eight and twelve participants. To foster a conducive environment for open dialogue and ensure that participants shared common ground, these groups were segmented based on specific demographics and affiliations. The segmentation included two FGDs with women's groups, two with youth groups, two with community elders, and two with members of Water Sanitation and Hygiene Committees (WASHCOMs). Each focus group discussion was designed to last between 90 and 120 minutes, allowing ample time for in-depth exploration of the topics.

3.4. Data Collection Instrument:

3.4.1. Household Questionnaire Survey: A survey was designed in line with Angelsen and Lund (2011). The questionnaire was drafted in both English and Hausa to gather information. It was divided into five parts. The first part focused on the respondents socioeconomic and demographic characteristics. The second part looked water accessibility, source reliability and collection practices. The third part explored what people think about water quality and any health issues related to it. The fourth part aimed to understand their knowledge and views on water policies and the organizations that manage them. Finally, the fifth part assessed how willing people are to get involved in managing water resources in their communities. The survey used a mix of questions, including those with a rating scale from 1 to 5, multiple-choice options, and open-ended questions for more detailed answers.

3.4.2. Key Informant Guide: A guide for semi-structured interviews was created to delve into several key areas. These included the processes behind policy reforms and how effective they are perceived to be, the coordination between different institutions and their working relationships, the capacity for enforcing regulations and any difficulties encountered, how resources are allocated and the limitations imposed by budget constraints, the importance placed on environmental sustainability, and finally, suggestions for making policies better.

3.4.3. Focus Group Discussions: The discussions covered a range of subjects. These included residents' experiences with water accessibility and its quality, what they thought about water committees and ways to report problems, their sanitation habits and awareness of water-source-latrine separation, any environmental changes they'd noticed like shifts in groundwater or drought, and ideas for making policies better.

3.5. Data Collection Procedures:

Data collection exercise was performed from November 2025 to February 2026. A household survey was carried out by 12 trained enumerators, who spoke both Hausa and English. These enumerators underwent two days of training on ethical guidelines, how to administer the survey, and how to ensure data accuracy. The lead researcher, along with two research assistants, conducted interviews with key informants. These interviews were recorded with permission and then transcribed word-for-word. Focus group discussions were led jointly by the researcher and a community liaison officer, with detailed notes taken and the discussions also being audio recorded.

3.6. Data Analysis:

3.6.1. Quantitative Analysis: The data was put

into SPSS (version 26) for analysis. We calculated basic statistics like frequencies, percentages, averages, and standard deviations for all the data points. To see if there were connections between different categories of data, like the type of water source and if people reported waterborne diseases, we used Chi square tests. Any result with a p value less than 0.05 was considered statistically significant.

3.6.2. Qualitative Analysis: The qualitative data, comprising interview transcripts and focus group discussion (FGD) notes, were systematically analyzed using NVivo 14. This analysis was guided by Braun and Clarke's (2006) established six-phase framework for thematic analysis. The process began with familiarization with the data, followed by initial coding to identify key concepts. Subsequently, themes were generated, reviewed, and refined through definition. The final phase involved the write-up of the identified themes. A dual approach was employed for theme identification, incorporating both deductive reasoning, which aligned themes with the pre-defined research questions, and inductive reasoning, allowing themes to emerge organically from the dataset.

3.6.3. Integration: To synthesize the findings, a joint display matrix was employed. This methodological approach facilitated the integration of quantitative results and qualitative themes by juxtaposing them within a structured format. Such a presentation enabled a thorough examination for convergence, where findings from both data types aligned; divergence, highlighting areas of discrepancy; and complementarity, where qualitative themes provided deeper context or explanation for quantitative observations. This integrated analysis aimed to provide a more comprehensive understanding of the research phenomena.

4. Results

4.1. Socioeconomic and Demographic Characteristics of Respondents

Out of the 487 household heads in the investigated households, 56.3% were men and 43.7% were women. The average age was about 43 years, with a standard deviation of 13.2 years. When it came to education, there was a mix: 28.5% had no formal education, 31.2% finished primary school, 25.8% finished secondary school, and 14.5% went on to tertiary education. Most of the respondents, 68.7%, worked in farming or agricultural jobs, while 14.3% were involved in trading or business, and 7.6% worked in the civil service. The average monthly household income was around ₦78,450 (which is about US$50), and nearly half of the households (47.2%) earned less than ₦50,000 per month.

4.2. Water Access and Source Reliability

4.2.1. Primary Drinking Water Source

The survey showed that most households get their water from groundwater. Specifically, 42.5% use boreholes (either mechanical or hand pump), and 24.8% use hand-dug wells. Piped water, which is mainly available in cities, is used by 18.7% of households. The remaining 14.0% get water from other places like unprotected wells, streams, or by buying it.

4.2.2. Distance and Collection Burden: Households, on average, are 1.8 kilometers away from their closest water source, with distances ranging from a very short 0.1 km to as far as 7.2 km. This distance is notably greater for households in rural areas, averaging 2.4 km, compared to those in urban areas, which are much closer at 0.7 km. The task of collecting water predominantly falls on women, who are responsible in 69.2% of households. Children handle collection in 15.1% of cases, and men in 12.4%, with other arrangements making up the remaining 3.3%. The entire trip to fetch water and return takes, on average, about 78 minutes, with a standard deviation of 41.2 minutes.

4.2.3. Supply Reliability: A large majority of households, 58.7%, deal with water shortages at least twice a week, and a significant 23.4% face daily shortages. It's rare for households to have a constant water supply, with only 9.6% reporting this. Water scarcity is much worse during the dry season, which typically runs from November to April, with 72.3% of people saying their water supply becomes much more limited then.

4.3. Perceived and Measured Water Quality

4.3.1. Perceived Water Quality: More than half of the people surveyed, 62.1%, think their drinking water isn't safe. The main reasons for this are that it tastes bad (41.3%), smells unpleasant (34.7%), has visible particles in it (29.8%), or has changed color (22.4%). Only about a quarter of respondents, 26.8%, actually treat their drinking water before drinking it. Of those who do treat it, most boil it (68.2%) and a smaller portion use chlorination (24.7%).

4.3.2. Household Water Treatment Practices: Out of the 26.8% of people who treat their water, the most common method is boiling, used by 68.2%. Chlorination is used by 24.7%, filtration by 5.3%, and solar disinfection by 1.8%. The main reasons why more people don't treat their water are the cost of fuel or chlorine, not knowing they should, and believing that water from boreholes is already safe to drink.

4.3.3. Reported Waterborne Diseases: Nearly half of households, 43.2%, experienced at least one waterborne illness in the past year. Diarrhea was the most frequent, making up 68.5% of all reported diseases, followed by typhoid (21.3%) and dysentery (10.2%). Young children were particularly vulnerable, with 52.7% of households that have children under five reporting diarrhea in that age group. Chi square analyses indicated that the type of water source is strongly linked to the occurrence of waterborne diseases ($\chi^2 = 28.3$, $df = 3$, $p < 0.001$), with unprotected wells showing the highest prevalence of illness.

4.4. Awareness of Water Policy and Governance

4.4.1. Policy Awareness: Respondents generally don't know much about water-related policies. Only about a quarter of those surveyed knew about the SURWASH program, and even fewer, just over 11%, were aware of the old Water Board Edict or the current law. People living in cities were much more likely to know about these policies compared to those in rural areas. Awareness of WASHCOM (Water Sanitation and Hygiene Committees) was a bit better, with almost a third knowing about a working committee in their area, but less than a fifth could actually name any committee members.

4.4.2. Perceptions of Government Responsiveness: Majority of the respondents were not happy with how the government handles complaints about water issues. Only a small fraction, about 12%, thought the government's response was good or excellent. Nearly 29% found it to be fair, while a much larger group, almost 59%, rated it as poor or very poor. The main reason for this unhappiness, mentioned by over two-thirds (67.2%) of those who were dissatisfied, is that there's no follow-up after they report problems.

4.4.3. Community Participation: A mere 24.6% of respondents indicated prior attendance at community meetings concerning water management. For those who had not participated, primary barriers included a lack of invitation (52.3%), time constraints (24.8%), and a perception of meeting ineffectiveness (15.6%). Furthermore, Focus Group Discussions (FGDs) revealed a consistent pattern of female exclusion from decision-making processes related to the siting and management of water infrastructure.

4.5. Focus Group Discussions Findings

4.5.1. Women's Perspectives on Water Access and Safety:

Female respondents consistently highlighted the significant time demands associated with water collection as their foremost challenge.

For instance, a participant from Dutsin-Ma detailed a strenuous daily routine beginning at 4:30 am to access a borehole, resulting in delayed school attendance for her children and pre-farm exhaustion. She further elaborated on the hardship incurred by a broken borehole, necessitating a 3 km journey to an alternative source, which had led to her daughter's significant school absenteeism. Moreover, women voiced considerable dissatisfaction regarding their exclusion from consultations on the placement of water infrastructure.

A participant from Funtua recounted a situation where the all-male water committee selected a borehole location near the mosque, prioritizing

male convenience, despite its remoteness from areas predominantly used by women for domestic purposes. Complaints about this decision were met with a dismissive response, urging them to express gratitude.

4.5.2. Youth Perspectives on Environmental Change: Young participants demonstrated an understanding of environmental deterioration but expressed a limited capacity to enact change, as exemplified by a participant from Danyashi sampled community.

"When my father was my age, the wells never dried up. Now, in April and May, we dig deeper every year. The water tastes strange—salty, sometimes metallic. We heard it is fluoride from the rocks, but no one explains what to do about it."

Another participant connected water scarcity to migration:

"I am learning to repair mobile phones because farming is no longer reliable. If water continues to disappear, I will move south. Many of my friends already have." (FGD-02, male youth, Danyashi).

4.5.3. Community Elders on Sanitation and Well Protection: Elder in the community recognized the difficulties in adopting sanitation practices: One participant shared:

"We understand the risks associated with placing latrines close to water sources, but our limited living spaces make it challenging to find an alternative location. We believe the government should offer both advice and financial assistance for constructing improved latrines, rather than solely focusing on providing boreholes. (FGD-04, Elder, Kaikai).

Another elder participant highlighted a cultural dimension:

"Within our customs, some family compounds share access to a single well. Relocating this well would necessitate the displacement of several households, indicating the complexity of such a change." (FGD-04, Elder, Kuringafa).

4.6. Environmental Sustainability Indicators

4.6.1. Open Defecation Free (OGF) status:

A recent study documented that Katsina State achieved Open Defecation Free (ODF) status in November 2025, with 27 of its 34 Local Government Areas (LGAs) receiving official certification. A senior representative from the Federal Ministry of Water Resources highlighted Katsina as a "major highlight of the celebration," positioning it alongside Jigawa as one of only two ODF states in the nation. Nevertheless, qualitative data from study participants indicated a potential limitation in the ODF certification process, as it prioritizes the availability of latrines over their proximity to water sources. This distinction is critical for maintaining groundwater quality, suggesting a need for further consideration in future ODF assessments.

4.6.2. Groundwater Quality: In the surveyed Local Government Areas (LGAs), a significant majority of participants (57.3%) indicated a decline in water quality over the past decade. Conversely, 24.6% observed no change, while 18.1% reported an improvement, which they attributed to the installation of new boreholes equipped with treatment systems.

4.6.3. Environmental Restoration Under ACReSAL: Analysis of existing data reveals that the ACReSAL program has achieved significant environmental and social impact, successfully rehabilitating over 30,000 hectares of degraded land and providing support to more than 2.5 million individuals. Furthermore, the state has advanced its water infrastructure by constructing 180 solar-powered boreholes and revitalizing tree nurseries in Dikke, Kabukawa, and Daura. A notable infrastructural achievement is the construction of a water conservation structure in Faskari Local Government Area, valued at N14.05 billion, boasting a substantial storage capacity of 700,000 cubic meters.

4.7. Integration: Joint Display of Quantitative and Qualitative Findings

Table 1: An Integrated Quantitative and Qualitative Findings

Dimension	Quantitative Finding	Qualitative Theme	Integration
Water access	58.7 % of households experience shortages ≥2×/week	Women describe daily time burden and school absenteeism	Access deficit translates directly into gendered social costs
Water quality	62.1 % perceive water as unsafe; 43.2 % report waterborne disease	Community members report metallic taste, salinity; lack of treatment knowledge	Perceived risk aligns with reported disease; treatment gap due to awareness and cost
Policy awareness	23.4 % aware of SURWASH; 11.2 % aware of Edict reform	Informants note reforms not yet visible at community level	Policy communication gap: reforms exist on paper but not in community experience
Institutional trust	59.0 % rate government responsiveness as poor	FGDs report unaccountable WASHCOMs, non-functional grievance committees	Low trust in institutions undermines community participation and sustainability
Well-latrine separation	(Secondary data: average 11.4 m)	Informants cite no enforcement; elders cite compound space constraints	Structural gap: standards exist but are not enforced; local constraints not addressed
Climate vulnerability	72.3 % report worse dry season scarcity	Youth report declining water tables, migration out-migration	Climate change is not an abstract future risk; it is lived experience

Source: Field Survey, 2025

5. Discussion

5.1. The Policy-Practice Gap: Implementation as the Binding Constraint

This study highlights a significant disconnect between water resource management policies and their practical application in Katsina State. Despite substantial policy reforms, including the repeal of a previous edict, the substantial SURWASH program, and the Open Defecation Free (ODF) declaration, tangible improvements in water quality, access, and environmental sustainability at the community level remain elusive. This outcome is consistent with policy implementation theory, which posits that increased complexity in decision-making and the number of actors involved can hinder policy success which coincides with several researches

conducted in Nigeria (Grace, et, al, 2025; Ben et, al., 2021) and other developing region (Gallegos et, al., 2026; Dirwai et, al., 2021).

Furthermore, the research identified institutional fragmentation, with five distinct agencies operating independently, leading to a failure in coordination. This is exemplified by the uneven distribution of WASH facilities in schools, where some have redundant infrastructure while others lack any facilities, resulting in an inequitable access to resources and perpetuating geographical disparities. Although the SURWASH Project Coordinating Unit represents a positive development, it currently lacks the authority to enforce changes in the core budgets and work plans of these agencies.

5.2. Environmental Sustainability: The Overlooked Dimension

The data indicates a significant disparity in policy focus, with a disproportionate amount of political and financial resources allocated to increasing water access, such as drilling boreholes and serving more people. In contrast, aspects crucial for long-term water security—including water quality protection, aquifer recharge, pollution control, and climate change adaptation—are inadequately funded. This imbalance is apparent in four key areas.

The issue of inadequate separation between wells and latrines, with an average distance of only 11.4 meters compared to the World Health Organization's recommendation of 30 meters, has been recognized for over ten years but remains unresolved. The finding was in line with Nenninger et, al., (2023) and (Orner et al, 2018) that reported that latrine pits are not designed with the primary objective of preventing fecal contaminants from migrating into subsurface soils or groundwater. Instead, their fundamental purpose is to provide a physical barrier between humans and their excreta. Consequently, pit latrines can function as localized sources of chemical and microbial pollution within the subsurface. This risk is amplified when soil characteristics are inadequate for pollutant assimilation or when the groundwater table is shallow, a scenario particularly concerning in communities reliant on hand-dug wells or handpumps for accessing groundwater (Smith and Sutton, 2012; Butterworth et, al., 2023).

The State Environmental Protection Agency (SEPA) lacks the capacity for effective enforcement, with only four officers responsible for regulating 34 Local Government Areas (LGAs). Moreover, the absence of a statewide building code for rural sanitation means there is no legal framework to mandate proper separation distances.

Additionally, water quality monitoring is conducted sporadically rather than on a regular basis. The state depends on academic research and limited donor-funded evaluations instead of a government-managed surveillance system. Consequently, contamination is typically identified only when public health issues arise.

Moreover, groundwater extraction is currently unregulated. The extensive drilling of boreholes—including 120 hand pump boreholes, 25 solar-powered boreholes, an additional 50 hand pumps and 46 solar-powered boreholes under construction, 3,000 approved tube wells for irrigation, and 180 ACReSAL solar boreholes—raises serious concerns about the sustainability of these resources. There is no existing plan for aquifer management, nor are there any enforced limits on water abstraction.

Furthermore, climate change adaptation has not yet been systematically incorporated into planning. Despite Governor Radda's notable commitments at the ChangeNOW 2026 summit, which include targets for 50% renewable energy adoption and a 25% increase in forest cover by 2030, water infrastructure planning has not fully integrated seasonal climate forecasts. The 2026 Seasonal Climate Prediction suggests a delayed start and earlier end to the rainy season in northern Katsina, yet regulations for abstraction permits and reservoir operations do not take these projections into account.

5.3. Community Participation: Rhetoric versus Reality

Basically, even though groups like WASHCOMs and committees for handling complaints are set up, it seems like they're mostly for show and don't actually have much power. Women are often left out of decisions, there are

no set meeting times, no real way to complain, and fees aren't collected properly. This means people aren't truly involved in a meaningful way.

This is similar to what's been said about managing local resources – if these committees don't get real power, information, or ways to be held accountable, they either get controlled by powerful locals or just don't do anything. With only about a quarter of people showing up to meetings and many who don't attend thinking they're pointless, it's clear that people don't see much value in how they're currently being asked to participate.

5.4. The Nexus of Water, Energy and Climate

Switching to solar-powered boreholes for projects like ACReSAL and SURWASH, as well as for schools and health centers, is a good move to cut down on running costs and reliance on diesel. Using renewable energy helps ease the strain on the connection between water and energy use, and it also helps with climate change. But, for these solar systems to last, we need people who know how to fix them, a good supply of spare parts, and a way to cover costs through user fees. Right now, none of these are really in place yet.

The ACReSAL program's all-in-one strategy, which includes saving water, fixing up land, planting trees, and helping farmers, is a great example of how water management policies should think about how everything is connected. The problem is, ACReSAL has an end date, and we don't have a plan yet to make its methods a regular part of how the government works.

5.5. Comparison with National and State Context

Katsina's success in becoming Open Defecation Free (ODF) is pretty impressive, especially since only two other states in Nigeria have reached this point. It's even been called a "major breakthrough" for the country's sanitation goals. The catch, though, is that ODF status mainly means people have toilets, not necessarily that they're safely located away from water sources like wells. The national checks for ODF don't even look at how far toilets are from wells, which could make people think their water is safe when it might not be.

Considering the bigger picture, Nigeria isn't going to hit its Sustainable Development Goal for clean water and sanitation (SDG 6) by 2030. Even though the government says it's committed, financial issues, climate change, and a fast-growing population mean the goal is getting further away. Katsina's story shows that even with good plans and a lot of money, success can be held back by problems with actually carrying things out, enforcing rules, and getting communities truly involved.

6.0. Recommendations

6.1. Policy and Legal Reform:

The abrogation of the 1971 Edict necessitates the subsequent enactment of a thorough Water Resources Act. This legislation should incorporate critical provisions, including a framework for groundwater abstraction licensing, robust mechanisms for the enforcement of water quality standards, and the establishment of environmental flow requirements. Furthermore, the proposed law ought to institute a singular State Water Resources Commission, vested with overarching authority across all relevant governmental agencies.

A significant deficiency exists in the lack of legally binding standards for the separation of wells and latrines. It is imperative that the state implement a building code mandating a minimum separation distance of 30 meters between these structures. Additionally, the code should stipulate the use of sanitary seals for wells and establish penalties for any violations of these regulations.

Transitioning from sporadic academic investigations to a systematic, government-led water quality monitoring program at the Local Government Area (LGA) level is recommended. This routine monitoring should utilize field-deployable test kits to assess fundamental parameters such as turbidity, chlorine residual, the presence of E. coli, and fluoride levels.

6.2. Institutional Strengthening:

To enhance environmental protection efforts, it is crucial to augment the staffing levels within the State Environmental Protection Agency (SEPA). Concurrently, the provision of mobile laboratory equipment is essential to facilitate on-site testing and analysis. Furthermore, delegating enforcement authority to the Local Government Area (LGA) levels will enable more localized and responsive regulatory action. Finally, integrating environmental health inspections with sanitation certification processes will create a more cohesive and effective system for ensuring public health and environmental safety.

The existing Project Coordinating Unit should be transformed into a permanent Water Sector Coordination Council endowed with the statutory authority to synchronize agency work plans, monitor geographical coverage to prevent redundancy, and publicly report on overall performance.

The WASHCOMs should be granted formal legal standing, provided with access to modest grants for upkeep, and receive comprehensive training in financial administration, methods for addressing grievances, and the principles of gender-inclusive decision-making processes.

6.3. Environmental Sustainability

Groundwater potential maps should be translated into legally enforceable abstraction limits, with a particular focus on regions experiencing high demand. Furthermore, a network of monitoring wells should be established to facilitate the tracking of both water levels and quality.

Climate risk assessments should be mandated for all substantial water development initiatives. Borehole drilling must be conducted in accordance with projected recharge rates, and reservoir designs should be enhanced to provide greater storage capacity, serving as a buffer against prolonged dry periods.

The integrated approach of ACReSAL should be incorporated into the budgetary allocations of the Ministry of Environment and the Ministry of Water Resources. This integration will serve to connect water conservation efforts with land restoration and reforestation initiatives.

6.4. Community Engagement and Accountability

Grievance redress committees should be established and activated, complete with well-defined reporting pathways, publicized meeting schedules for public engagement, and specific timelines for responses. Additionally, water quality data at the community level should be published annually in a simplified format and in the local language.

A minimum of 40% female representation is required on Water, Sanitation, and Hygiene Committees (WASHCOMs) and other water-related decision-making bodies. To facilitate women's active participation in meetings, provisions for childcare and transportation support should be made available.

Information regarding water reforms, SURWASH projects, and potential water quality risks should be disseminated via radio, identified as the most trusted medium through surveys. This communication should be conducted in the Hausa language, supplemented by community theater performances and announcements made at public places such as mosques.

7.0. Conclusion

This study examined water resource management policies and their environmental sustainability effects in Katsina State, Nigeria, using a mixed-methods design. A household survey of 487 individuals, 18 key informant interviews, and 8 focus group discussions were conducted. Quantitative findings revealed substantial issues, with 58.7% of households facing water scarcity at least twice weekly, 62.1% deeming their drinking water unsafe, and 43.2% reporting waterborne illnesses in the preceding year. The average water collection distance was 1.8 km, with women performing this task in 69.2% of households. Policy awareness was low, with only 23.4% aware of SURWASH and 11.2% of Edict reform. Qualitative data underscored ongoing governance problems, including fragmented institutions, weak regulatory enforcement, a critical proximity issue between wells and latrines (averaging 11.4 meters), non-functional WASHCOMs, and the exclusion of women from

decision-making. Key informants noted that policy reforms had not yet produced observable community-level improvements, and focus groups indicated widespread dissatisfaction with unresponsive institutions.

The disconnect between policy and practice in Katsina State is attributed to deficiencies in implementation frameworks, enforcement capacity, and community accountability mechanisms, rather than flaws in policy formulation. The state has demonstrated commitment through significant budget increases, allocating N50 billion to water in 2025 and N897.86 billion to the overall budget for 2026. Substantial infrastructure investments, including N31.8 billion for Zobe Phase 1B and N14.05 billion for ACReSAL, coupled with institutional advancements like the repeal of the 1971 Edict and the introduction of the SURWASH program, highlight this political will. Despite these considerable inputs, the outcomes regarding water quality and environmental sustainability have not been proportionate.

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