PLASU Journal of Environmental Sciences, E-ISSN 2360-9222, Vol.1, No. 2, December, 2024,
Published by the Faculty of Environmental Sciences, Plateau State University, Bokkos.
https://journals.plasu.edu.ng, DOI: 10.5281/zenodo.21854300

Assessment of the State of Urban & Rural Water Supply Program in Plateau State, Nigeria; Case of the Southern Region

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ABSTRACT

This paper seeks to assess the state of Urban & Rural Water Supply program in the Southern Region of Plateau State, Nigeria, by examining the current level of water supply services and by the examination of the existing institutional linkages and relationships among actors and stakeholders, foster coordination and collaboration in all service delivery arrangements. This is with a view to make recommendations towards improving and enhancing access to water and transferring competencies for community-led service delivery. A mixed method approach was used to assess the status of WASH services, satisfaction level and Mapping of communities with existing water supply facilities to decide their spatial distribution and attributes. The qualitative based evidence from 6 semi-structured face-to-face interviews with ward leaders from 6 case studies (communities) and the existing documents reviewed (WASH department at LGCs within the study area). A multiple sectioned questionnaire was used in the survey and the sections include; The tool used is the UNICEF–WaterAid WASH program. The questionnaires were administered and returned representing 80% returned rate. Based on response 0.9 rate for the Cronbach's Alpha of the data shows coefficients used to test for reliability or consistency. The results revealed that 82% of rural settlements were dispersed, with such settlements having limited access to basic amenities, improved water sources, and 62% of the communities having such access. The institutional linkages indicated that there is a weak institutional linkage to make water readily available within the zone, affecting adequacy of water supply within the zone. However, schools (57%), PHCs (69%), and public spaces (55%) all have improved water points, hence efforts need to be put in place to address the disparities in sanitation and water

access to improve the quality of life generally. Based on the results obtained, recommendations were made to help the policy makers, practitioners and the academia.

Key words: Program, Plateau State, Southern Zone, Sustainable, Water Supply,

1. INTRODUCTION

The urban and rural water supply programs in developing countries are essential for ensuring access to safe and reliable water sources, which is critical for public health, economic development, and environmental sustainability Milkecha & Itefa (2020). Water supply programs in developing countries typically aim to provide both urban and rural populations with access to potable water. These programs are often characterized by a dual focus: addressing the immediate needs of urban areas while simultaneously working to improve water access in rural communities as argued by Omada, (2018) & Pietrucha-Urbanik & Tchórzewska-Cieslak (2018).

Urban water supply systems are generally more developed than rural systems, often benefiting from better infrastructure and investment. However, they still face significant challenges, including: infrastructure decay, rapid urbanisation, pollution and contamination amongst others.

Many urban water systems are aging and suffer from leaks and inefficiencies, leading to significant water loss (Milkecha & Itefa, 2020). The influx of people into urban areas often outpaces the ability of water supply systems to expand, resulting in inadequate service delivery and increased pressure on existing resources as opined by Jidauna, Dabi, Saidu, Abaje & Ndabula (2013); (2014). Urban water sources are frequently threatened by pollution from industrial activities and inadequate waste management, complicating efforts to provide safe drinking water (Seixas & Berkes, 2010).

Rural water supply programs are crucial for improving the quality of life in less populated areas are faced with challenges such as limited resources and community engagement. Rural areas often lack the financial and technical resources necessary to develop and maintain water supply systems. This includes a shortage of trained personnel and inadequate funding for infrastructure projects as presented by Wapwera (2014).

The dispersed nature of rural settlement and populations can make it difficult to implement water supply systems effectively, often requiring innovative solutions tailored to the specific needs of communities Jidauna, Dabi, Saidu, Abaje & Ndabula (2014). Successful rural water supply programs often depend on community involvement and ownership. Programs that fail to engage local populations may struggle to achieve sustainability and effectiveness for water provision (Pietrucha-Urbanik & Tchórzewska-Cieslak, 2018).

Recent initiatives emphasize the importance of integrating urban and rural water supply efforts. The Asian Development Bank (ADB) highlights the need for a holistic approach that recognizes the interconnections between urban and rural water systems. This includes addressing land use, pollution control, and sustainable resource management to ensure that both urban and rural communities benefit from improved water supply and sanitation services (Wapwera, Songden & Bot, 2015).

The urban and rural water supply programs in developing countries face a myriad of challenges, from infrastructural decay and resource limitations to the need for community engagement, Milkecha & Itefa, (2020). Addressing these challenges requires a coordinated approach that integrates urban and rural strategies, ensuring that all

populations have access to safe and reliable water sources. Continued investment, capacity building, and community involvement are essential for the success of these programs, ultimately contributing to broader goals of sustainable development and public health Milkecha & Itefa, 2020).

The World Bank-financed Sustainable Urban and Rural Water Supply Program (SURWASH) supports the Government of Nigeria. The program has been implemented for over six years in seven states and the Federal Ministry of Water Resources (FMWR) from May 2021 to June 2027. Plateau State is one of the seven states participating in the SURWASH Program. The Program is implemented in the urban and Rural Water Supply Sectors.

The underpinning theory that would be used to explain the basic components of the paper is the urban governance and management theory. Urban Governance and Management explains that every system is support by a government which is structured to ensure certain set goals are achieved and in this instance a water supply in both urban and rural areas and in this instance southern zone of Plateau State, Nigeria hence the theories are; Institutional theory, Urban regime, Regulatory theory and the Systems theory (Giddens, 2000; 2006; Scott, 2005; Litman, 2011; JMDB, 2006; Davoudi, 2009; Rydin, 2011). But for the purpose of this paper emphasis will be placed on the Structuration and Regulatory theory and these would be used to bring about further clarification as governance and management issues are raised (Rahman & Abdullah, 2016).

This paper seeks to assess the state of Urban & Rural Water Supply program in Plateau State, Nigeria; Case of the Southern Region, this is with a view to make recommendations along the project's life cycle and similar projects that could be implemented. This could be achieved through the following objectives; by examining the current level of water supply services and by examining the existing institutional linkages and relationships among actors and stakeholders.

The review synthesizes findings from various studies conducted in different developing contexts, highlighting key determinants of water supply satisfaction.

1.1. Level of Water Supply Services and Household Characteristics

Household characteristics significantly determine the demand or need for water and subsequently influence access to water supply services in both urban and rural settings. Special consideration of water supply services is the factors influencing their satisfaction levels. Household characteristics have the following as key factors; socio-economic status, household size, education level, and geographical location. Furthermore, this water provided would be considered in terms of five (5) attributes which includes; Water Supply Services and Quality, Factors Influencing Satisfaction Levels, Mapping of Communities' Existing Water Supply Facilities, spatial Distribution Patterns and attributes of Water Supply Facilities amongst others. All these would address the level of water supply services and household characteristics Daloeng,(2006).

1.1.1 Socio-Economic Status

Households with higher income levels tend to have better access to improved water supply services. A study in Adama City, Ethiopia, found that wealthier households

reported higher satisfaction levels with water supply services compared to lower-income households, who often relied on less reliable sources such as boreholes or unprotected wells (UNDP, 2019).

1.1.2 Household Size

Larger households often face greater challenges in accessing sufficient water supply. Research indicates that households with more members tend to experience higher levels of dissatisfaction due to inadequate water quantity and quality (UNDP,2019).

1.1.3 Education Level

Education plays a crucial role in understanding water supply issues and utilizing available services effectively. Households with higher education levels are more likely to be aware of water quality standards and the importance of safe drinking water, leading to greater satisfaction with the services provided Jidauna, Dabi, Saidu, Abaje & Ndabula (2013); (2014) and Milkecha & Itefa (2020)

1.1.4 Geographical Location

Urban households typically have better access to piped water systems compared to rural households, who may rely on communal taps or wells. A study in Southern Ethiopia revealed that only 47% of urban residents were satisfied with their water supply, while rural communities faced more significant challenges due to infrastructure limitations as opined by Daleong, (2016) and Pietrucha-Urbanik & Tchórzewska-Cieslak (2018).

1.2. Water Supply Services and Quality

The quality of water supply services is a critical determinant of household satisfaction. Several dimensions of service quality influence how households perceive their water supply (Omada, 2018; Asian Development Bank, 2020).

1.2.1 Reliability and Consistency

The frequency and reliability of water supply are paramount. Households that experience intermittent supply or frequent outages report lower satisfaction levels. In Asmara, Eritrea, a study found that only 34% of households were satisfied with the water services, primarily due to irregular supply and long cut-off periods as argued by Jidauna, Dabi, Saidu, Abaje & Ndabula (2013); (2014) and Milkecha & Itefa (2020).

1.2.2 Water Quality

The safety and portability of water directly impact household satisfaction. Contaminated water sources lead to health issues, which in turn affect perceptions of service quality. Studies have shown that households receiving treated water report higher satisfaction levels compared to those relying on untreated sources (Abubakar, 2016; Jidauna, Dabi, Saidu, Abaje & Ndabula, 2013; 2014; Milkecha & Itefa, 2020; Omada, 2018; Asian Development Bank, 2020).

1.2.3. Customer Service

Effective communication and responsiveness from water service providers significantly influence customer satisfaction. Research indicates that households that feel their concerns are addressed by service providers are more likely to express satisfaction with the water supply services as opined by Milkecha & Itefa (2020) and Abelkassim, Daniel & Esayas, (2024).

1.3 Factors Influencing Satisfaction Levels

Understanding the factors that influence satisfaction levels is essential for improving water supply services in developing economies. These could be observed at the following levels; Community Engagement, Government Policies and Infrastructure Investment levels see table 1.

Table 1: Levels of satisfaction of water supply services

SN	Level of Satisfaction	Statements on the level of satisfaction of water supply services
1	Community Engagement	Involving communities in decision-making processes regarding water supply can enhance satisfaction levels. Studies suggest that when households participate in planning and management, they are more likely to feel a sense of ownership and satisfaction with the services.
2	Government Policies	Effective governance and regulatory frameworks are crucial for ensuring equitable access to water supply services. Policies that prioritize the needs of underserved communities can lead to improved satisfaction levels. For instance, the implementation of policies aimed at reducing non-revenue water can enhance service delivery and customer satisfaction as argued by Abubakar (2016).
3	Infrastructure Investment	Investment in water supply infrastructure is critical for improving service quality. Research indicates that upgrading distribution networks and reducing leakage can significantly enhance the reliability of water supply, leading to increased satisfaction among households [2].

Source: Compiled by authors from various sources, 2024

The characteristics of households concerning water supply services and their satisfaction levels are influenced by a complex interplay of socio-economic factors, service quality, and community engagement. Addressing the challenges faced by households, particularly in underserved areas, requires targeted interventions that consider these characteristics. Policymakers and water service providers must prioritize infrastructure investment, effective governance, and community participation to enhance water supply services and improve satisfaction levels in developing economies.

1.4 Mapping of Communities' Existing Water Supply Facilities

Access to clean water is a critical issue in developing economies, where inadequate water supply facilities can lead to severe public health challenges and hinder socio-economic development. Mapping existing water supply facilities and understanding their spatial distribution and attributes is essential for effective water resource management as argued by Katun, Alhaji, Zango,& Zainab, (2021). This literature review synthesizes research on

the mapping of water supply facilities, spatial distribution patterns, and implications for community water access.

1.4.1. Importance of Mapping Water Supply Facilities

Mapping water supply facilities serves multiple purposes, including:

1.4.1.1. Resource Management

Effective mapping allows for the identification of existing water sources, helping in the management and allocation of water resources.

1.4.1.2. Planning and Development

Spatial data can inform infrastructure development, ensuring that new facilities are strategically located to meet community needs.

1.4.1.3. Policy Formulation

Detailed maps provide essential information for policymakers to design interventions aimed at improving water access and quality.

1.4.2. Spatial Distribution Patterns

The spatial distribution of water supply facilities often reflects socio-economic and geographic factors.

1.4.2.1. *Urban vs. Rural Distribution*

Urban areas typically have better access to piped water systems, while rural communities often rely on boreholes and wells. Research indicates that urban centers experience higher service efficiency, but rapid population growth can lead to disparities in water access (Seixas & Berkes, 2010; Malik, Yusof & Roosli, 2022).

1.4.2.2. *Geographical Factors*

The geology and hydrology of an area significantly influence the availability of water resources. For instance, in regions with deep groundwater, communities may struggle to access potable water, as seen in Misau Town, where geological conditions hinder the development of effective water supply systems as argued by Jidauna, Dabi, Saidu, Abaje & Ndabula, (2014).

1.4.2.3. *Inequity in Access*

Studies have shown that the distribution of water supply facilities is often inequitable, with marginalized communities facing greater challenges in accessing clean water. This inequity can lead to health disparities and socio-economic disadvantages as opined by Milkecha & Itefa (2020).

1.5. Attributes of Water Supply Facilities

Understanding the attributes of water supply facilities is crucial for assessing their effectiveness and sustainability.

1.5.1. *Quality and Reliability*

The quality of water supplied and the reliability of access are critical attributes influencing user satisfaction. Research highlights that facilities providing treated water generally lead to higher satisfaction levels compared to those relying on untreated sources as observed by Jidauna, Dabi, Saidu, Abaje & Ndabula (2013).

1.5.2. *Capacity and Maintenance*

The capacity of water supply facilities to meet community needs and the effectiveness of maintenance practices are essential for ensuring long-term sustainability. Studies indicate that poorly maintained facilities can lead to service interruptions and reduced user trust (Jidauna, Dabi, Saidu, Abaje & Ndabula, 2013 and Katun, Alhaji, Zango, & Zainab,2021).

1.5.3. *Community Engagement*

Engaging communities in the planning and management of water supply facilities enhances their effectiveness. Research emphasizes the importance of local involvement in decision-making processes to ensure that facilities meet the specific needs of the population (Katun, Alhaji, Zango, & Zainab,2021).

In conclusion, mapping communities' existing water supply facilities and understanding their spatial distribution and attributes are vital for improving water access in developing economies. The application of GIS and community engagement in mapping efforts can enhance resource management, inform policy decisions, and ultimately lead to better health and socio-economic outcomes for communities. Continued research and investment in mapping technologies will be crucial for addressing the challenges of water supply in developing regions.

1.2 Institutional Linkages and Relationships

The relationships that exist among actors and stakeholders to foster coordination and collaboration for Effective service delivery in developing economies requires strong institutional linkages and collaborative relationships among various stakeholders. These linkages facilitate the coordination of resources, knowledge, and expertise to address complex development challenges. This literature review examines the significance of institutional linkages, the types of stakeholders involved, and the benefits of fostering collaboration for improved service delivery. See Table 2.

Table 2: **Significance of Institutional Linkages**

SN	Linkage	Statement of crucial role	References
1	**Facilitating resource mobilization**	Linkages allow for the pooling of financial, human, and material resources from multiple stakeholders, enabling more comprehensive and effective interventions as argued by	Seixas & Berkes (2010).
2	**Promoting knowledge sharing**	Institutional linkages facilitate the exchange of knowledge, skills, and best practices among diverse actors, leading to improved service quality and innovation	Malik, Yusof & Roosli(2022).
3	**Enhancing coordination and reducing duplication**	Established linkages help to coordinate the activities of various stakeholders, minimizing overlap and ensuring efficient use of resources	Malik, Yusof & Roosli(2022) and Seixas & Berkes (2010).

Source: Compiled by author from various sources, 2025.

Institutional linkages play a crucial role in enhancing service delivery.

Furthermore, another level of the enhancement of services delivery in the water sector has it fixed on stakeholder's involvement and the institutions that determines its viability.

2.2.1 Types of Stakeholders Involved

Key stakeholders in institutional linkages for service delivery include:

2.2.2 Government agencies

Local and national government entities play a central role in service delivery and provide the regulatory framework for collaboration (Seixas & Berkes, 2010; Malik, Yusof & Roosli, 2022).

2.2.3 Non-governmental organizations (NGOs)

NGOs often serve as intermediaries between communities and service providers, facilitating grassroots engagement and advocacy (Seixas & Berkes, 2010).

2.2.3 International organizations

Multilateral and bilateral agencies provide funding, technical assistance, and policy guidance to support service delivery initiatives.

2.2.4 Private sector

Private companies can contribute resources, expertise, and innovative approaches to service delivery partnerships.

2.2.5 Community-based organizations

Local groups and associations represent the interests of communities and ensure that services are responsive to their needs (Seixas & Berkes, 2010).

2.2.6 Benefits of Fostering Collaboration

Institutional linkages and collaboration among stakeholders offer several benefits for service delivery (Seixas & Berkes, 2010).

2.2.7 Improved access and equity

Coordinated efforts can help to reach underserved populations and ensure equitable access to essential services (Seixas & Berkes, 2010).

2.2.8 Enhanced sustainability

Collaborative approaches that engage multiple stakeholders are more likely to be sustained over the long term, as they foster shared ownership and commitment (Seixas & Berkes, 2010).

2.2.9 Increased accountability

Institutional linkages promote transparency and accountability among service providers, as they are subject to scrutiny from various stakeholders as argued by Wapwera, Mallo & Jiriko, (2015).

2.2.10 Fostering innovation

Collaboration among diverse actors encourages the development and testing of new approaches to service delivery, leading to improved outcomes see figure 3.2. (Seixas & Berkes, 2010)

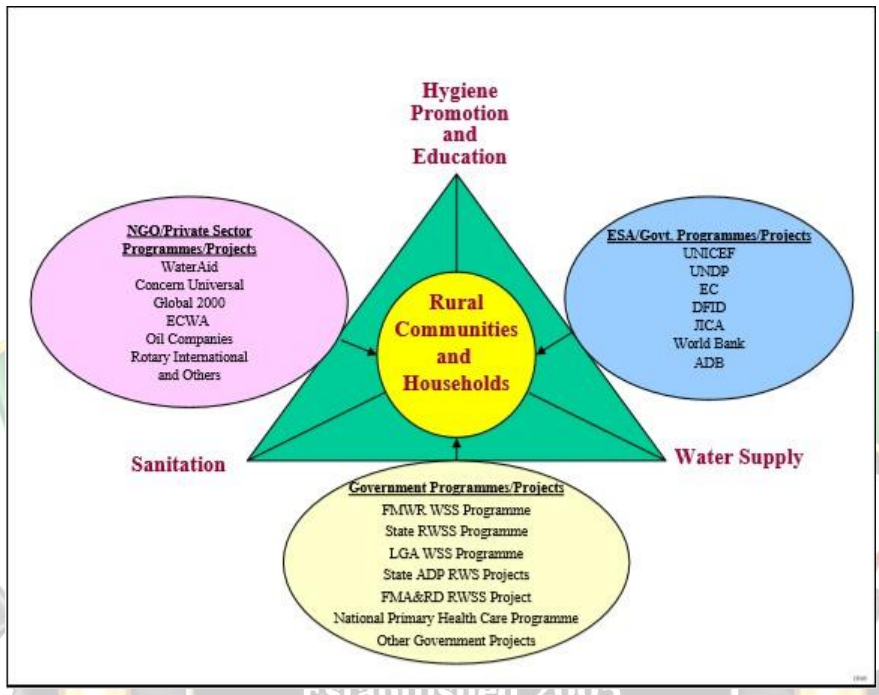


Figure 3.2: Conceptual Framework of the National RWSS Programme

Source: National Rural Water Supply Programme, 2016

Institutional linkages and stakeholder collaboration are essential for effective service delivery in developing economies. By fostering coordination among government agencies, NGOs, international organizations, the private sector, and community-based groups, service delivery initiatives can leverage diverse resources, knowledge, and expertise to achieve greater impact. Policymakers and development practitioners should prioritize the strengthening of institutional linkages and the promotion of collaborative approaches to address complex development challenges and improve service delivery outcomes.

To end this literature review, it would be important to observe that the southern zone of Plateau state is not different from other developing states and zones in Nigeria that are experiencing water related issues, especially water distribution systems that existed even before the creation of Plateau as a state and zone in Nigeria. To ensure that this paper achieves its primary objectives it is imperative to note that, other studies were carried out on water in Plateau state such as that by Ryeshak, et al., (2015); Cotton, (2016) and Ziyok, (2018).

2. MATERIALS AND METHODS

2.1. The study area

The choice of the region is informed by the fact that the region has its administrative headquarter as one of the areas covering the southern region of Plateau State, Nigeria. It has several dialects with common agricultural activities as their source of livelihood, with a

relatively high temperature, hard soils, with a thick vegetal cover and general lowland as many within the state call the region.

Five local Government Areas (LGAs) in Plateau State participate in the WASH Program. They are Langtang North, Langtang South, Wase, Mikang, Shendam and Quaan Pan LGAs. Plateau Rural Water and Sanitation Agency (PRUWASSA) is collecting baseline data on access to WASH services. For more details see figure 1.

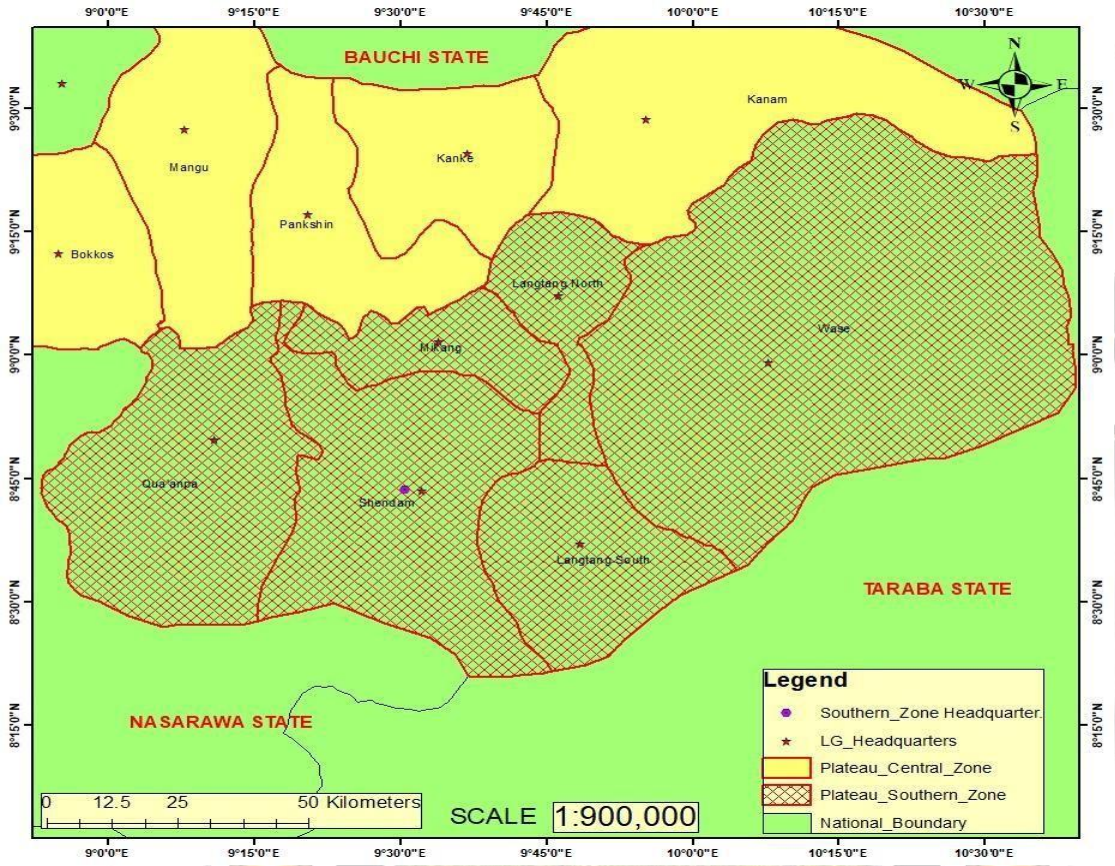


Figure 1: Plateau state indicating the 3 senatorial zones
Source: Authors fieldwork, 2025

2.2. Population and Sampling technique

The population of the study area was drawn from the 5 local government areas within the zone. The stratified sampling technique was adopted; 3 LGAs were drawn representing 60% from the zone and for each LGA, it was further sub-zoned and on the sampled zones, the clustered sampling was used to select the household heads for the questionnaires to be administered, while systematic random sampling was adopted to select points of location of water facility developed or undeveloped.

2.3. Nature of Data required

The data required for this study are drawn from the current level of water supply services within the study region through the participatory engagement of communities to inform the planning of interventions based on evidence. The data is both qualitative and quantitative in nature, while the source of data was primary.

The survey design (Longitudinal) was adopted for data collection fashioned in three stages, stage one is for the development of the operational plans, and instruments of data collection, stage two is for data collection and stage three is for data analysis, presentation, validation, and report writing.

2.4. Instruments of Data collection

The instruments of data collection were adopted from the UNICEF – WaterAid WASH program. There are 2 tools (questionnaires), these are: Community Mapping questionnaire and Household survey questionnaire. The questions in each of the tools were doctored in a hand-held device i.e tablets or an android phone. The questions were structured and developed on the Kobotoolbox which has the capacity to read maps and to locate houses in the study area.

The data was collected using a hand-held device, the android phone (tablets) with an installed mobile application, with its improved GPS accuracy while in the field. Using and navigating the module application data was collected and uploaded to the cloud. The data collection team administered the survey tools to target project areas and collect feedback per operational plans. Conducted spot checks water sources and provide on-the-spot remedial action.

The uploaded data was downloaded and compiled according to objectives having a set database for analysis. Analysis to be done based on the aggregated data about quality indicators to find the general profile of households.

2.5. Data analysis and limitations

The Microsoft Excel software was used to analyze the quantitative data. The data analytics function was used to analyze both ordinal and nominal data sets. Based on the data available downloaded from the Kobo Toolbox. A head database was developed, data cleaning was conducted. The data was analyzed using frequencies, counts, and other statistical methods. The results obtained were further analysed using a one-way anova (F-ratio) to consider the relationship within and between the various water sources in the study area.

The limitations and challenges during the data collection were minimal, mainly because this was not the first time the researchers and field assistants conducted data collection using technology, i.e., phones, tablets, and Kobo toolbox for WASH investigations. The main challenge was delineating the boundaries of the two communities, as there is a history of boundary disputes around the area. The difficulty around the inherent data collection exercise (eligible households are not accessible, reluctance from respondents) was that rain presented

the primary difficulty as it is the rainy season, which had minor delays in data collection. However, as highlighted, quality control was conducted on a real-time and daily basis to give feedback to enumerators on the field.

3. RESULTS AND DISCUSSION

3.1. Household Characteristics and the Level of Water Supply Services

For the purpose of this paper the following would be considered as it relates to water supply services and satisfaction levels; Household Characteristics and Water Supply Access, Existing Water Supply Services and Quality and Factors Influencing Satisfaction Levels amongst others.

3.1.1. Household characteristics within the Communities in the Area

This section presents the household characteristics within the study zone, see table 1.

Table 1: Number of **questionnaires administered** within the Communities within the study Zone

Zone	The number of rural communities found	Number of questionnaires administered
Southern Zone of Plateau State	13	26
	11	22
	15	30
	12	31
	11	22
	16	32
	7	14
	17	35
	19	39
	13	25
	10	25
	29	60
	13	24
Total	**186**	**385**

Source: Authors Fieldwork, 2024.

The table indicated that 385 questionnaires were administered to 186 communities within the zone.

3.1.2 Household Characteristics

This section considers the socioeconomic and demographic characteristics of the study area. These issues would be discussed in relation to the water supply program as it affects the area. From the data analyzed 97% who participated in this survey have stayed in the community for more than 5 years, and most, 87%, are married. The family status of the household is 66% monogamous and 34% polygamous, which provides insights into the diversity of family structures within the community. The principal occupation of people

living in Southern zones within rural areas is farming, 85%. Of interest is that 76% are literate in a language which underscores the importance of education and communication within the community.

The implications of the status of the respondents who participated in this survey are significant. 97% of the respondents have stayed in the community for over 5 years, indicating a strong sense of community stability and long-term residency. Additionally, the high percentage of married individuals (87%) suggests a family-oriented community. Furthermore, the prevalence of farming as the principal occupation at 85% shows a predominantly agricultural economy in the rural areas within the study area. For further details see Table 2.

Table 2: Socio-economic and demographic characteristics of households in rural areas of the zone.

Indicators for Characteristics	Category	Percentage
Duration of stay in the community	> 5 years and above	97%
	1 year to 2 years	1%
	2 to 5 years	2%
	6 months to 1 year	1%
Marital Status of Head of Household	Married	87%
	Separated	1%
	Single	4%
	Widowed	9%
Family status of household	Monogamous	66%
	Polygamous	34%
The main occupation of the head of households	Civil Servant	4%
	Employee of Private Business	1%
	Farmer	85%
	Housewife	2%
	Others Specify	1%
	Professional	0.3%
	Retired/Pensioner	3%
	Self Employed	1%
	Student	1%
	Trader	2.0%
Literacy in any language	No	24%
	Yes	76%

Source: Authors Fieldwork, 2024

Table 2 presents information on the characteristics of indicators, categories of the indicators and the percentages of the categories. The implication of the above information shows that the households with higher education levels are aware of water quality

standards and the importance of safe drinking water, and their level of satisfaction with the services provision is high.

3.1.3 Gender of the People in Respondent Households

Figure 1 shows that 24% of respondents are female and 76% male, respectively. This finding signifies a dominantly higher percentage of males than females among rural respondents. The findings suggest that there is a significant gender imbalance among rural respondents, with a much higher representation of males than females as argued by Zhou & Hesketh (2017). This may have implications for understanding the preferences, behaviors, and needs of the rural population, as well as for designing targeted interventions and services to address any potential disparities.

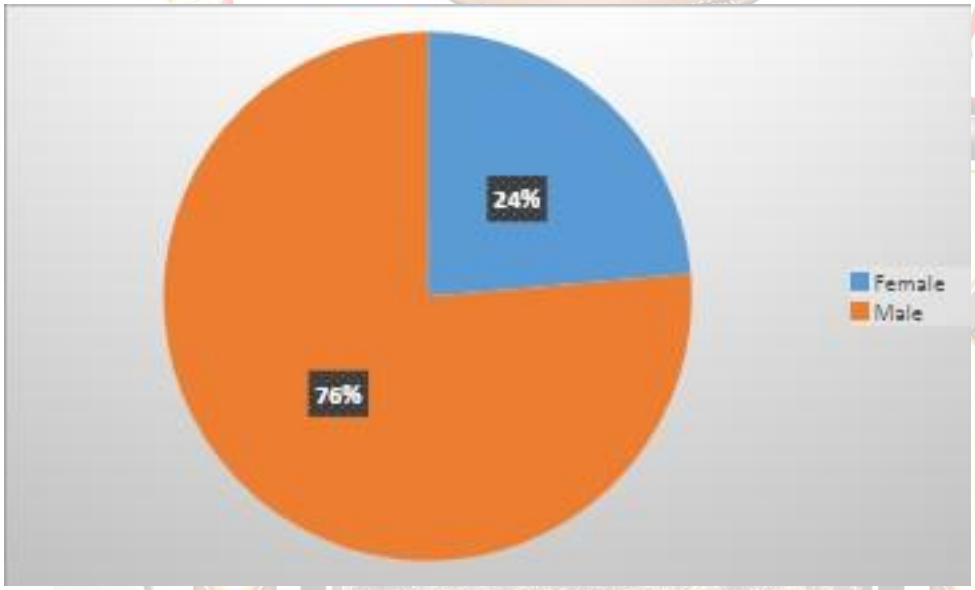


Figure 1: Gender Distribution in Respondents' Households

3.1.4 Age Distribution of the Respondents

Figure 1 shows the age distribution in respondent's households: 3% are between ages 15 and 18 years, 10% are between 18 and less than 30 years, 30% are between 30 and less than 40 years, 26% are between greater than 40 years and less than 50 years, 16% are between 50 years and 60 years and 16% are more than 60 years.

The age distribution in respondents' households indicates that there is a fairly diverse range of ages represented. The majority of respondents fall between the ages of 30 and 60, which suggests a significant presence of middle-aged and older individuals within the households. This information could be important for various purposes, such as targeting different age groups for specific products or services, designing age-appropriate marketing strategies, or understanding the potential distribution of needs and preferences across different age categories within the population under study.

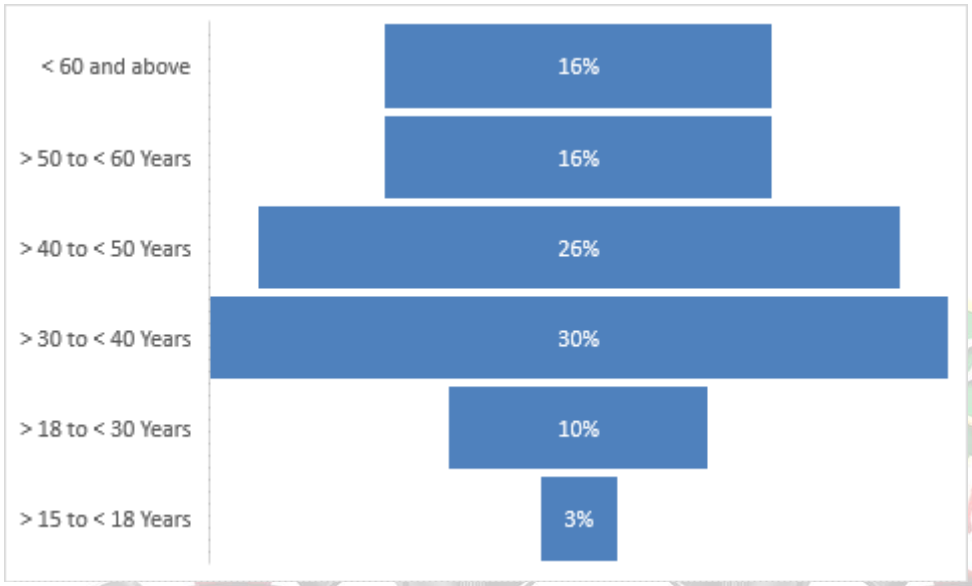


Figure 2: Age distribution of Respondent's household members in the zone

Source: Authors Field Work, 2024

Figure 2 shows the distribution of household members within the southern zone of the state with age range from 30-50 years being over 50% of the respondents. The implication of this is that the age group have the capacity to participate in community engagement. The challenges faced by households, particularly in underserved areas, requires targeted interventions that consider these characteristics. Policymakers and water service providers must prioritize infrastructure investment, effective governance, and community participation to enhance water supply services and improve satisfaction levels in the said communities where the water service is provided.

3.1.5: Level of Satisfaction with Water Supply Services

The level of satisfaction shows that 82% of the respondents in the study region are not satisfied with the current water supply service, and only 20% are satisfied with the current service. See Figure 3.

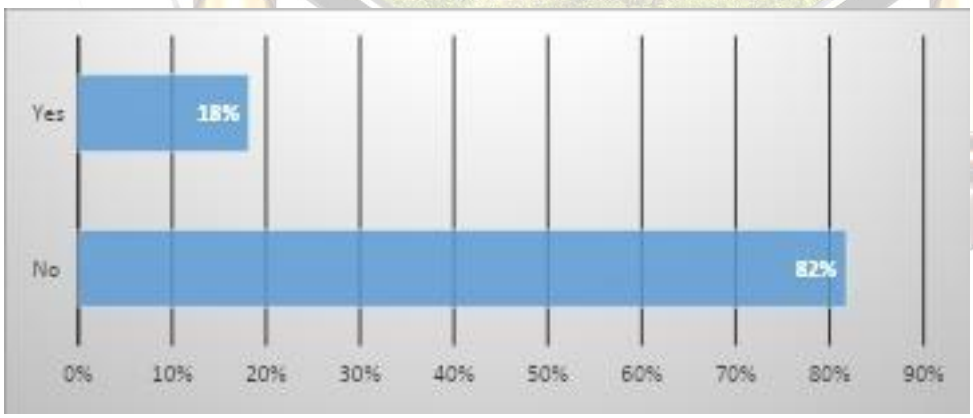


Figure 3: Level of Satisfaction with the water supply services in the Area

Source: Authors Field work, 2024

Figure 3 suggests a significant need for improvement in the quality and accessibility of the water supply service to meet the residents' needs and expectations. It may also point to potential issues with the current water supply infrastructure or management that require attention.

Furthermore, the Communities' Existing Water Supply Facilities were mapped and emphasis was made on the existing water supply facilities and their spatial distribution and attributes which are vital for improving water access in most of the communities. The application of GIS and community engagement in mapping efforts can enhance resource management, inform policy decisions, and ultimately lead to better health and socio-economic outcomes for communities. For the purpose of this paper emphasis are placed on the mapping of the water facilities sources captured in schools, markets, and PHCs.

3.1.6 Water Points in Rural Areas

In mapping improved water sources in 244 rural communities, 11 % were captured in schools, markets 2.2%, and PHCs 5.6% where data on their water sources. The type of water sources points within the sampled communities are mostly 82% hand pump boreholes, 1% improved hand-dug wells, and 17% motorized schemes see table 3. There are improved water sources in locations such as the community, market, PHC and schools within the region see table 3.

Table 3: Location of Improved Water Sources in Communities

Ward	Community	Market	PHC	School	Total
	4	0	3	0	7
	25	1	1	4	31
	23	0	0	2	25
	18	0	0	2	20
	7	1	0	3	11
	21	0	0	2	23
	11	1	2	0	14
	2	0	0	0	2
	21	0	0	0	21
	10	0	0	0	10
	7	0	0	0	7
Southern Zone of Plateau State	48	3	6	13	70
	21	0	3	4	28
Grand Total	**218**	**6**	**15**	**30**	**269**
Per %	**81**	**2.2**	**5.6**	**11**	**100**

Source: Authors Fieldwork, 2024

Table 3 shows the 269 points of available water sources in the three institutions and the communities. 218 locations, 30 in schools, 15 in PHC and 6 in Markets are within the communities in the study area. The implication is that the majority of the water facilities

and points are within the community where the majority of the population live, work and play.

Further analysis using a one-way anova (F-ratio) see table shows there is

Table 4: Analysis of variance (F-ratio) improved water sources in communities and in various institutions (Markets, PHCs and Schools).

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2353.442	3	784.4808	**18.90315**	3.11E-08	**2.798061**
Within Groups	1992	48	41.5			
Total	4345.442	51				

Source: Authors Fieldwork, 2024

From table 4, statistically, the results showed that there is no significant relationship between the institutions; Markets, PHCs, Schools and the communities in Southern zones of Plateau State. This is necessitated by the fact that the value to be used for determination is F which states that *if the F crit score is 2.79 which is less than F and the value calculated is 18.90,* hence the decision therefore will be that there is no statistically significant relationship as over 80% of the water points are located within the communities.

Furthermore, mapping water is conducted to obtain the nature of the various sources of water and their types and condition see Table 5.

Table 5: State of water sources within the region

Ward	Hand Pump Borehole	Improved Hand Dug Well	Motorized Borehole	Total
	6	0	1	7
	28	0	3	31
	19	3	3	25
	14	0	6	20
	8	0	3	11
	19	0	4	23
	8	0	6	14
	2	0		2
	18	0	3	21
	7	1	2	10
	7	0		7
	66	0	4	70
Southern Zone of Plateau State	18	0	10	28
Total Per %	220 82%	4 1.5%	45 16.72	269 100

Table 5 shows the 269 points of water available water sources and the various types vis; Hand Pump Borehole 220, Improved Hand Dug Well 4 and Motorized Borehole 45. Representing 82%, 1.5% and 16.72% respectively. The implication is that majority of the water facilities and points are within the community and are manually operated i.e hand pump boreholes.

Drawing from the above it could be concluded that the distribution of the water supply facilities is adequate as majority are located within the community even though the analysis of variation is not statistically significant in terms of distribution. This agrees with the argument of Katun, Alhaji, Zango,& Zainab, (2021) saying that distribution determines effectiveness. Also, the quality and reliability of water sources influences user satisfaction. Improved water facilities lead to higher satisfaction levels compared to those relying on untreated sources. The results obtained here confirms the work of Jidauna, Dabi, Saidu, Abaje & Ndabula (2013); (2014) and Milkecha & Itefa (2020) amongst others in terms of the quality and reliability of water sources as their attributes.

The ownership and functionality of the water supply facilities would be considered in this section as part of mapping and its distribution within the region or zone of study. For further insight into the ownership and provision see Table 6.

Table 6: Ownership of Water Schemes

Type of Water Scheme	Private	Public
Hand Pump Borehole	11	209
Improved Hand Dug Well	-	4
Motorized Borehole	-	45
Total	**11**	**258**
Percentage	4%	96%

Source: Authors Fieldwork, 2024.

Table 6 shows the ownership type either private or public. It indicated that 96% of the ownership is public with 4% only for private. It shows the government is responsible for the provision which is owing to possible cost of provision and availability of funds. The fact that the water schemes are publicly owned signifies an opportunity for the public to have access to water.

Public ownership of water schemes signifies that water resources are managed with the broader public interest. This allows for equitable access to water, ensuring that it is not solely controlled for profit-driven purposes. Therefore, it highlights the commitment to providing clean and safe water to communities without being hindered by profit motives see provision by private and public in table 6. This in itself is meeting goal 6 of the SDGs.

Consequently, a careful consideration shows the age and duration of the water schemes from 1983-2024 see figure 3.

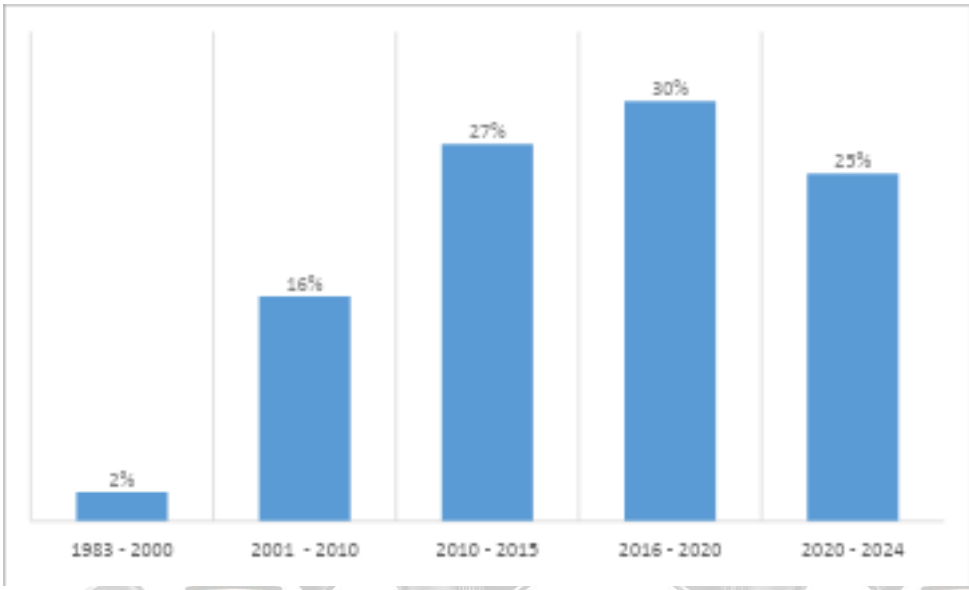


Figure 4: Duration of Water Schemes

Source: Authors Fieldwork, 2024

Figure 4, shows that 25% of water schemes were constructed between 2021 and 2024, 30% between 2016 and 2020, 27% between 2011 and 2015, 16% between 2001 and 2010, and 2% between 1983 and 2000.

These findings suggest that a significant portion of water schemes were constructed relatively recently, between 2016 and 2024. This may indicate a period of increased investment and focus on improving water infrastructure. Conversely, a smaller percentage of schemes were constructed between 1983 and 2000, highlighting the need for continued infrastructure development and maintenance in older schemes. These findings could inform future investment and resource allocation decisions in the water sector.

The second section for consideration is the functionality of the Motorized Schemes, the 29 motorized schemes are powered by solar power 70%, generators 27% and windmills 2%. see Table 7.

Table 7: Functionality of Motorized Powered Water Schemes

Type of Water Scheme	Abandoned /Not completed	Never functioned	Not now, but previously	Functioning	Total	Per %
Generator	0	2	4	6	6	21%
Solar	2	1	20	9	22	76%
Windmill	0	0	1	0	1	3%
Total	**2**	**3**	**25**	**15**	**29**	
Percentage	**4%**	**7%**	**56%**	**33%**		**100%**

Source: Authors fieldwork, 2024

Table 7 shows that only 15 (33%) of water schemes are functioning, 3 4% are abandoned or not completed, 3 (7%) never completed, and 25 (56%) were previously working but not functioning at the time of this study. Interestingly, 40 (89%) are solar-powered schemes, which is commendable, but with the high cost of diesel, it is expensive for communities to operate diesel-powered generators. A major reason for the result is as a result of the windmill also not functioning.

The findings indicate a significant issue with the functionality of water schemes in the area. The low functioning rate of only 15 out of 45 water schemes is concerning, as it negatively impacts the communities that rely on them. The high percentage of solar-powered schemes is commendable, but the cost of operating diesel-powered generators is a significant barrier for communities. Additionally, the non-functioning windmill further exacerbates the water supply challenges. These findings suggest the need for interventions to improve the functionality and sustainability of water schemes and explore alternative cost-effective power sources for these schemes.

The Functionality of Handpump Boreholes is very cardinal as a major point of water supply. See Table 8.

Table 8: Functionality of Hand-pump Boreholes

Type of Water Scheme	Abandoned/ Not completed	Never functioned	Not now, but previously	Yes	Total
Hand Pump Borehole	2	14	51	153	220
Percentage	**1%**	**6%**	**23%**	**70%**	

Source: Authors Fieldwork, 2024

Table 8, shows that 153 (70%) of hand pump boreholes were functioning, 51 (23%) were not functioning, 14 (6%) never functioned, and 2 (1%) were abandoned or not completed. It is encouraging to note that a majority of handpump boreholes were found to be functioning. This indicates that a considerable portion of the water sources are operational and provide access to clean water. However, it is also concerning that a notable percentage of the boreholes were not functioning or never functioning. This suggests that some challenges and issues must be addressed to ensure the sustainability and functionality of these water sources.

Furthermore, the presence of abandoned or incomplete boreholes indicates a potential waste of resources and highlights the importance of proper planning and maintenance. These findings emphasize the need for ongoing monitoring, maintenance, and support to ensure that hand pump boreholes continue to provide communities with reliable access to clean water.

3.1.7. Functionality of Water Facilities

Throughout the period of study (1-2 weeks) it was observed that the hand pump boreholes in rural areas, 70% were found to be functional, but only 46% of the motorized boreholes were functional. See Figure 5

The implication of this finding is that hand pump boreholes have a significantly higher functionality rate compared to motorized boreholes in rural areas. This suggests that handpump technology may be more reliable or easier to maintain in rural settings compared to motorized systems. It also highlights the need for further investigation into the factors contributing to the discrepancy in functionality rates between these two types of boreholes. See figure 5.

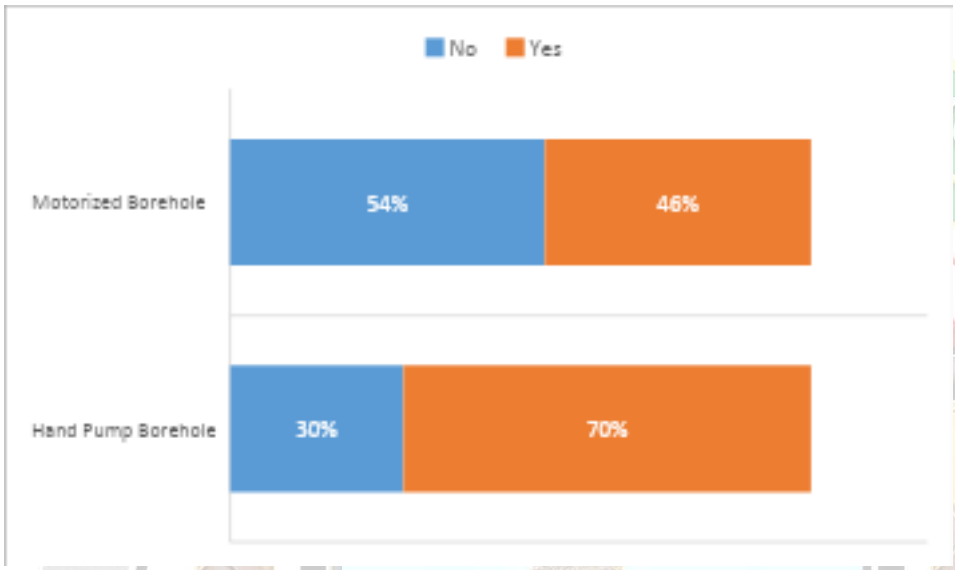


Figure 5: Functionality Rate of Water Schemes in Rural Areas

Source: Authors Fieldwork, 2024

From the above discussions based on the results obtained, it is very clear that the issues of Resource Management, Planning and Development and Policy Formulation are clearly not properly handled. The issues of repairs and maintenance after a huge investment by way of installation of the boreholes and wells becomes very essential as resources need to be managed well and in a sustainable manner, hence the need for proper/adequate planning before provision of the water point or source of water in any given location.

Finally, from the results obtained policies can be formulated drawing from the results obtained for instance; while the communities have more boreholes than the other locations such schools, PHC and markets, those in the communities are also more functional.

3.1.8 Attributes of Water Supply Facilities

Understanding the attributes of water supply facilities is crucial for assessing their effectiveness and sustainability which are greatly dependent on Quality and Reliability, Capacity and Maintenance and Community Engagement.

In the case of Capacity and Maintenance, 70% were found to be functional which is a pass mark but not adequate because there is the need to meet community needs and the effectiveness of maintenance practices are essential for ensuring long-term sustainability without service interruptions which reduced user trust. Finally, there is the need for local

involvement in decision-making processes to ensure that facilities meet the specific needs of the population and meet user/customer satisfaction.

3.2. Institutional Linkages Among Actors and Stakeholders

Policymakers and development practitioners should prioritize the strengthening of institutional linkages and the promotion of collaborative approaches to address complex development challenges and improve service delivery outcomes.

Institutional linkages and stakeholder collaboration are essential for effective service delivery within and across the zone. There is a need to foster coordination among both public and the private sector. It could include community-based groups, service delivery initiatives which could leverage diverse resources, knowledge, and expertise to achieve greater impact as it relates to water supply service delivery within the zone under scrutiny.

In Nigeria today, policies concerning the natural environment are drawn from the Sustainable Development Goals (SDGs specifically Goal 6). These policies are not implemented in full for many different reasons ranging from weak institutional framework, low community mobilization, poor ownership culture, high poverty level and paucity of data amongst others. Today, as it has always been for a long time, waste has become a permanent component of most natural environments even though there has been a significant improvement in the recent past compared to the situation 5-10 years back.

60% of the respondents agreed that there exists a weak institutional framework in Nigeria and the zone as the impact is not felt owing to non-environmental protection and resources management have been limited as observed in the national nation in general. In the southern zone of Plateau State there has been a concerted effort to link socioeconomic development with environmental issues. Unfortunately, there are still inadequate waste disposal facilities, and poor waste management systems in most of the Urban Centers, Small Towns and Rural Areas. Untreated wastes are deposited into water courses such as streams, rivers and lakes despite these being natural water supply sources for the community. This leads to health problems associated with drinking of polluted and contaminated water leading to associated diseases such as cholera, diarrhea, typhoid fever and intestinal worm infections amongst others. It is still a common phenomenon to see people using unsanitary methods of human waste disposal such as open defecation or directly defecating into water courses.

3.2.1. Institutional Arrangement

In the southern zone of Plateau State, the provision of sanitation services is the responsibility of the State and the six Local Governments Councils, supported by the Federal Government through special intervention programmes or in collaboration with International Donor organizations.

The State Government operates through the following agencies:

- State Ministry of Water Resources and Rural Development
- Plateau Rural Water and Sanitation Agency (PRUWASSA)

- State Environmental Protection and Sanitation Agency

The State Ministry of Water Resources is the policy making, formulation and coordinating body for Water Supply and Sanitation. PRUWASSA is the implementation and management agency for water and sanitation activities.

For the purpose of this paper the Environmental Protection Agencies considered as institutional linkages include; Plateau State Environmental Protection and Sanitation Agency, six Local Government Councils.

3.2.2. Plateau State Environmental Protection and Sanitation Agency (PEPSA)

The Plateau State Environmental Protection and Sanitation Agency (PEPSA) is the main organ of the State Government for solid and industrial waste management. Environmental sanitation, also called environmental hygiene, has a number of areas that could be considered, namely the management of solid wastes, liquid or water wastes, and litter. Even though there are offices clearly spelt out in the southern zone of the state, health and sanitation units of the local government areas oversee the activities of water supply and hygiene. This is an activity aimed at improving or maintaining the standard of basic environmental conditions that affect the well-being of the people.

PEPSA has the mandate to ensure that the populace lives, works and plays in a clean and healthy environment. This is achievable through the:

(1) Provision of clean and safe water supply

(2) Provision of clean and safe ambient air

(3) Efficient and safe animal, human, and industrial waste disposal,

(4) Protection of food from biological and chemical contaminants, and

(5) Adequate housing in clean and safe surroundings

(6) Enrichment of the understanding of the ecological system and natural resources of Plateau State

(7) Enforcement of compliance of development projects with Environmental Impact Statement (EIS) and

(8) Provision of the necessary policies relating to environmental research and technology

The Plateau State Environmental Protection and Sanitation Agency (PEPSA) operates with the following Standards;

(1) Government or statutory agency standards and specifications enforced by law,

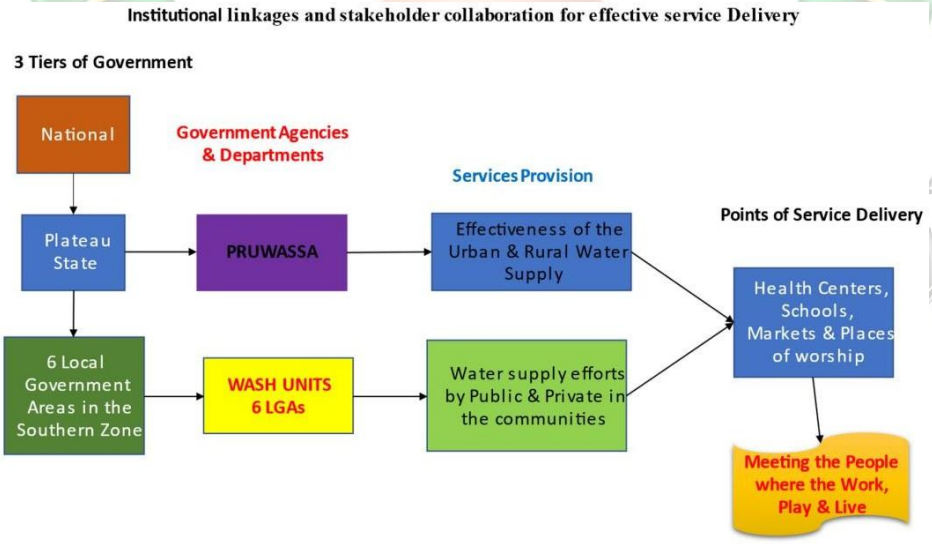
(2) Proprietary standards developed by a firm or organization and placed in public domain to encourage their widespread use, and

(3) Voluntary standards established by consultation and consensus and available for use by any person, organization, or industry.

In Plateau State the situation is not different from what is obtained in other places, hence with the inception of the third Republic, the Governor declared a state of emergency about environmental sanitation and a lot has been put in place but much remains undone.

3.2.3. Local Government Councils

The Local Government Councils share responsibility for provision of environmental and sanitation facilities with the State Government, especially in the semi-urban and rural areas in their domain. Their activities are carried out directly through the Health Department and Works Department (WASH Unit). For further details see figure 6.



Source: Authors Field Work, 2025

The survey results are attributable to such key factors as accessibility to water supply and other various infrastructural facilities. Water closets and septic tank toilets abound in households and public places such as; public schools, health centres, markets; shopping malls, open markets, motor parks and recreation centres, offices and religious places where public water supply flows constantly. The remaining households in the zone are compelled to use pit toilets or other forms of unimproved sanitation facilities.

4. CONCLUSION

The heavy reliance on public water sources, particularly in rural areas, raises concerns about the accessibility of clean and reliable drinking water. With 63% of households in rural areas relying on public water sources, infrastructure and water supply improvements are crucial to ensure safe and sustainable access to clean drinking water for residents of the southern zone. This paper highlights pressing challenges related to the heavy reliance on public water sources is crucial to improving overall health outcomes and well-being. A multi-faceted approach involving education, infrastructure improvements, and interventions to promote proper access to clean drinking water is essential to mitigate these challenges and enhance the quality of life for residents in these areas.

Due to the weak institutional linkage to make water readily available within the zone has affected adequate water supply for both rural and urban areas in the zone, hence a collaborative effort creating a strong synergy involving local authorities, community stakeholders, and relevant organizations are imperative to implement sustainable solutions and address the identified deficiencies effectively.

5. RECOMMENDATION

Based on the conclusions drawn the following recommendations were made to ensure a basis for improving the water supply services within the southern zone for the well-being of the communities.

Prepare a WASH investment plan for the zone and advocate for resources to improve access to clean and reliable drinking water in rural areas, particularly in communities heavily reliant on public water sources. Implementing interventions to improve water accessibility and ensure that all households have access to safe and reliable water sources is crucial.

A comprehensive plan to provide improved water supply to all PHCs, Schools, Markets, and Motor Parks within the zone. This plan could involve collaboration between government agencies, non-profit organizations, and local communities to ensure that all PHCs have access to adequate sanitation facilities. Additionally, there should be a focus on education and awareness programs to emphasize the importance of the provision of water for proper sanitation practices for public health.

Assess the feasibility of introducing improved water schemes and infrastructure in Wards with a high percentage of households depending on public water supply and to Conduct hydrogeological studies to address the challenges in areas with difficult groundwater viability. Encourage the development of private water sources, such as hand-dug wells, within household premises to enhance access to water, especially in areas facing challenges in water supply. Encourage operation and maintenance of water facilities provided by the public (Government).

Establish and strengthen partnerships with relevant stakeholders, NGOs, and government agencies to address the reliance on public water sources and improve water quality and sanitation in rural communities. Engage in community-led initiatives to empower residents to implement sustainable solutions for accessing clean drinking water and promote proper water management practices.

Conduct water quality surveillance and sanitary inspection of water points Develop, maintain, and update data management systems. Also, institutionalize monitoring systems.

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