Socio-Economic Factors and Water Supply in Bayelsa State

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Abstract

This study investigates the influence of socio-economic factors on water supply and sanitation in Bayelsa State, Nigeria, with a specific focus on how household income levels affect access to improved water sources across the local government areas (LGAs). Employing a descriptive survey design, the study draws on both primary and secondary data, with population projections made using an exponential growth model based on data from the National Population Commission. A sample of 400 households, proportionally distributed across the eight LGAs, was surveyed. Data were analyzed using descriptive statistics to summarize demographic and key variables, and inferential statistics, including chi-square tests, to examine relationships between socio-economic factors and water and sanitation access. Analysis was conducted using SPSS version 26.0 and Microsoft Excel. Based on the findings, it is recommended that public water infrastructure, particularly piped water and public tap systems, be expanded in underserved LGAs such as Brass and Ekeremor to improve access to clean water.

Keywords: socio economic, Water Supply, House Income, Water Sources,

Introduction

Water is a fundamental human right and a crucial resource for sustainable development, as recognized by the United Nations (2021). However, access to clean water and adequate sanitation remains a global challenge, particularly in developing regions where millions of people still lack reliable water sources. In many parts of the world, water insecurity is exacerbated by environmental degradation, population growth, and weak governance structures, making it difficult to implement sustainable solutions. The World Health Organization (2020) reports that billions of people worldwide do not have access to safe drinking water and improved sanitation facilities, increasing their exposure to waterborne diseases and reducing overall public health. These disparities are most pronounced in low-income regions, where inadequate infrastructure, poverty, and governance challenges prevent effective water management. Addressing this issue requires coordinated efforts from governments, international organizations, and local communities to ensure equitable access to clean water and sanitation. Governance inefficiencies further compound the problem, as weak policy implementation and lack of funding limit improvements in water supply infrastructure (Omole & Ndambuki, 2014). These challenges make achieving universal water and sanitation access a major priority for policymakers and development agencies in the region.

Nigeria, despite being one of Africa's largest economy, face severe challenges in ensuring adequate water and sanitation services for its populace. According to UNICEF (2018), over 60 million Nigerians lack access to clean water, while more than 100 million do not have adequate sanitation facilities. Rapid urbanization has further strained existing water infrastructure, leading

to severe shortages in densely populated areas. Poor governance and corruption have also impeded efforts to expand water access, as mismanaged funds and lack of regulatory enforcement have contributed to service inefficiencies (Eneh, 2011). Although several national programs and policies have been introduced to improve water supply and sanitation, implementation remains slow, and the impact is uneven across different regions. The challenge is even more pronounced in states with difficult geographical terrains and limited economic diversification, such as Bayelsa.

Bayelsa State, located in the Niger Delta region, is a paradox in terms of water resources. Despite being surrounded by rivers, creeks, and swamps, the state face severe challenges in providing clean and safe water for its residents. Pollution from oil exploration and improper waste disposal has significantly degraded the quality of natural water sources, increasing the risk of waterborne diseases and making water treatment more expensive (Ite et al., 2018). The swampy terrain further complicates the construction of conventional water infrastructure, raising the cost of building and maintaining water treatment plants and pipelines (Ohwo, 2019). These environmental and geographical constraints, combined with governance and economic challenges, have left many communities in Bayelsa reliant on unimproved water sources, exacerbating health risks and reducing overall quality of life.

Statement of the Problem

Bayelsa, an oil-producing state, has quite a high rate of poverty and unemployment; many houses cannot afford private water supply connections or sanitary amenities (Watts, 2004; Owolabi, 2016). Low-income households rely on irregular and occasionally contaminated public water sources as the cost of buying water from private providers is ridiculous. Rivers and marshes encircle the state; nonetheless, a substantial majority of its residents lack access to good sanitation facilities and safe drinking water. Many natural water sources have been contaminated by oil exploration, industrial activities, and inefficient waste management; many of them are now harmful for use and hence increase the occurrence of waterborne diseases including typhoid, diarrhea, and cholera (Ite et al., 2018).

Bayelsa's water supply and sanitation issues are made worse by serious governance problems. The Bayelsa State Water Board, which oversees water management, operates with limited technical capacity, poor institutional coordination, and a tight budget (Ohwo & Abotutu, 2014). There is no clear comprehensive water policy to sufficiently control sanitary facilities and water supply results in distributed and insufficient delivery of services. Public trust in government-run projects has been further undermined by financial mishandling of money set for water projects. Moreover, decentralization has not been done correctly, therefore depriving local government authorities of the tools or information needed to adequately supervise water supply and sanitation projects (Akpabio & Ekanem, 2009). Moreover, technically difficult and costly for development and upkeep is the swampy area with high water level (Ohwo, 2019). These natural limitations explain the poor availability of drinkable water which causes many families to depend on unimproved sources like rainwater gathering, untreated surface water, and shallow wells, all of which greatly jeopardize health.

Objectives

1. The study seeks to establish the influence of socio-economic factors on water supply and sanitation in Bayelsa state.
2. To examine how household income levels influence access to improved water sources across LGAs in Bayelsa State.

Hypotheses

H1: There is a significant relationship between household income levels and access to improved water sources across LGAs in Bayelsa State.

H0: There is no significant relationship between household income levels and access to improved water sources across LGAs in Bayelsa State.

Conceptual Review

Water Access and Availability

People in developing regions struggle to get clean water every day, especially in Bayelsa State in Nigeria's Niger Delta. Despite being surrounded by water, communities here face major challenges getting safe water for drinking, cooking, and cleaning. As Raimi et al. (2019) found, this daily struggle affects people's health, education, jobs, and social lives. The United Nations calls water access a basic human right, but the reality falls short of this ideal. According to UNICEF & WHO (2021), over 2 billion people, about one in four worldwide, lacked properly managed drinking water services in 2020. Rural areas and developing countries bear the heaviest burden. In Nigeria, the gap is clear: Abubakar (2019) discovered that 82% of urban households have improved water sources, compared to just 54% in rural areas. Bayelsa State faces extra challenges because of its complex landscape of rivers, creeks, swamps, and wetlands. This geography makes building water systems extremely difficult and expensive. On top of this, water sellers often act as middlemen, creating additional barriers for communities trying to access clean water.

Water quality is just as important as quantity. Research by Raimi et al. (2020) found alarming pollution in local wells throughout Bayelsa State. These wells contain dangerous levels of heavy metals, oil-based chemicals, and disease-causing microbes. This contamination makes water unsafe and causes widespread health problems, especially for children who suffer from diarrhea and other waterborne diseases. Families must spend their limited money on treating water or buying clean alternatives, taking resources away from food, education, and healthcare. Heavy metals in the water pose a particularly serious long-term threat, as they can cause lasting damage even in small amounts. Weak enforcement of environmental laws against polluting companies makes this problem worse. It's a sad irony a region rich in water resources where people still cannot access clean water because of pollution.

Money plays a major role in who gets clean water. Studies by Omole and Ndambuki (2014) show a clear pattern across Nigeria: wealthier households have better access to safe water. Richer families can drill private wells or install water treatment systems in their homes, ensuring they always have clean water (Hoelzel, 2024). Meanwhile, poorer families rely on public sources or untreated water that may be inconsistent or contaminated. This pattern extends to entire communities, with better water systems more common in wealthier areas (Emenike et al., 2017). This creates a cycle that keeps poor families' poor they spend so much time and money getting water that they have fewer resources for education, healthcare, and making a living. Water access isn't just about pipes and wells; it's about fairness and giving everyone an equal chance to thrive.

The burden of water collection falls unevenly on women and girls. Throughout Bayelsa State and Nigeria, they typically bear the responsibility for gathering water for their families. Akpabio and Subramanian (2012) documented how women and girls "spend hours each day working up the stream to fetch the water that nourishes the household." This takes a heavy toll on their lives. Girls miss school to collect water, limiting their education and future opportunities. Women have less time for paid work, community involvement, or rest. The physical strain of carrying heavy water containers over long distances can cause injuries and health problems. Women and girls also face

safety risks when traveling to remote water sources. Despite these serious impacts, many water projects fail to address gender issues in their planning. The Rights and Resources Initiative and Environmental Law Institute (2020) emphasize that water solutions must consider gender equality from the start. Improving water access isn't just about health, it's also an essential step toward treating women and girls fairly.

Water shortages affect entire communities in multiple ways. When children miss school to fetch water, they fall behind in their education, with girls suffering the most. Adults who spend hours securing water have less time to earn money, hurting both family finances and the local economy. Hunter et al. (2010) showed how these factors create a gap: communities with poor water access face higher medical costs from water-related illnesses while earning less money, pushing them deeper into poverty. Businesses and farms struggle to operate without reliable water, limiting job creation and economic growth. Tensions can rise when water becomes scarce, sometimes leading to conflicts between different groups. These wide-ranging impacts show why water access forms the foundation for community wellbeing and development across all sectors. We cannot separate water issues from other developmental challenges.

Despite significant obstacles, specific efforts are successfully improving water access in Bayelsa State. The region faces four major challenges: insufficient government funding for water infrastructure, technical difficulties maintaining water systems in remote areas, the delta's swampy geography that complicates pipeline installation, and widespread oil pollution contaminating water sources. Community-based water projects have proven effective when they position residents as decision-makers rather than aid recipients. Water systems show 60-70% higher longevity rates when community members directly participate in planning, construction, and maintenance activities. Ewim et al. (2023) documented three successful local initiatives: household rainwater harvesting systems in Ogbia communities, repairs to 37 existing boreholes across Southern Ijaw, and bio-sand filtration technologies implemented in riverine settlements. While international organizations and NGOs currently provide essential technical and financial resources, projects that transition to local management within 3-5 years demonstrate greater sustainability. These targeted interventions have improved water access for approximately 150,000 residents, but addressing the water crisis for all 2.3 million people across Bayelsa State requires a comprehensive approach involving coordinated government policy, community leadership, private sector investment, and civil society advocacy focused on achieving 100% water access by 2030.

Solving water problems requires looking at the bigger picture. Technical solutions must fit within the local culture, environment, and economic reality, especially considering climate change predictions for more flooding and changing rainfall patterns in the Niger Delta. Protecting water sources from pollution requires stronger enforcement of environmental laws, particularly against the oil industry that has severely degraded water quality in the region. As Ohwo (2019) wisely notes, "enhancing access to source of water is not only relevant technically but it is so also socially and politically." This highlights how water connects to governance, power relationships, and resource decisions. Sustainable solutions must balance immediate needs with long-term environmental protection, ensuring water sources remain available for future generations. Community involvement is essential not just for identifying local priorities but also for building the social connections and management skills needed to maintain systems and resolve conflicts. Meeting the Sustainable Development Goals for water in Bayelsa State requires unprecedented cooperation across different sectors and groups, including traditionally marginalized voices, while addressing the underlying inequalities that determine who gets water and who doesn't.

Looking forward, Bayelsa State needs transformative approaches to achieve water security for all. Future water strategies must prepare for climate change impacts like altered rainfall, extreme weather, and rising sea levels that threaten both infrastructure and water quality. Policies must prioritize helping disadvantaged groups first, rather than primarily serving those who already have advantages—a common pattern in past water projects. New funding approaches are needed, possibly including public-private partnerships, community-managed funds, and targeted support for vulnerable populations to ensure everyone can afford clean water. Combining scientific data with traditional knowledge that has guided local water management for generations offers another promising direction. Digital technologies can help monitor water quality, manage distribution systems, and gather community feedback to improve accountability. Educational programs about water conservation, sanitation, and system maintenance can maximize the impact of infrastructure investments. At the most fundamental level, achieving water security in Bayelsa State requires addressing broader governance challenges, including corruption, industry influence over regulators, fragmented authority, and limited government capacity. Progress requires recognizing water's multiple dimensions, as a human right, economic resource, environmental necessity, and cultural asset, while prioritizing the most vulnerable communities currently suffering the greatest water insecurity.

Socioeconomic Factors Affecting Water Supply and Sanitation

Access to adequate water supply and sanitation services in any community is influenced by various socioeconomic factors. The Water, Sanitation, and Hygiene (WASH) framework provides valuable insights into these factors, highlighting the critical areas that impact access and utilization of water and sanitation services.

Income Level: Household income levels significantly affect access to water supply and sanitation services. Lower-income households often face financial barriers that limit their ability to afford safe drinking water and adequate sanitation facilities. Households with higher income levels can afford to invest in improved water supply and sanitation services. They can pay for piped water connections, purchase bottled water, and install private sanitation facilities, which offer better hygiene and convenience. Conversely, low-income households often rely on free or low-cost alternatives such as unprotected wells, rivers, and open defecation, which are typically unsafe and unreliable (IBM, 2020). These economic disparities lead to reliance on unsafe water sources and inadequate sanitation practices, which are prevalent in Bayelsa State (UNICEF 2019; WHO, 2019)."

Employment Status: Employment status influences household priorities and spending on essential services, including water supply and sanitation. Households with stable employment are more likely to invest in improved water and sanitation infrastructure. Stable employment provides a steady income, which is critical for affording improved water supply and sanitation services. Employed individuals and households with regular income are more capable of paying for piped water connections, bottled water, and private sanitation facilities. In contrast, those with unstable employment or low-income jobs may struggle to afford these services, leading to reliance on unsafe alternatives (UNICEF, 2018). Conversely, unemployed or underemployed individuals may struggle to prioritize such investments, resulting in inadequate access to these essential services (UNICEF & WHO, 2019)."

Urbanization and Water Demand

Urbanization and water demand are intricately linked, presenting both challenges and opportunities for water management in rapidly growing cities like those in Bayelsa State, Nigeria. As urban populations expand, the demand for water increases exponentially, putting pressure on

existing water infrastructure and resources. This relationship between urbanization and water demand is particularly complex in developing regions, where urban growth often outpaces the development of adequate water supply systems. In Bayelsa State, the process of urbanization is reshaping water consumption patterns and necessitating new approaches to water management. Understanding this dynamic is crucial for policymakers, urban planners, and water resource managers as they work to ensure sustainable water access for growing urban populations. The challenges of meeting increased water demand in urban areas are compounded by factors such as aging infrastructure, climate change, and competing water uses between domestic, industrial, and agricultural sectors.

The rapid pace of urbanization in Bayelsa State has significantly impacted water demand patterns. Ohwo (2019) examined the relationship between urban growth and water demand in Yenagoa, the state capital. The research found that the city's population growth rate of 2.9% per annum has led to a corresponding increase in water demand of approximately 3.5% annually. This discrepancy between population growth and water demand growth is attributed to changing lifestyles and increased per capita water consumption in urban areas. The study noted that as rural migrants move to urban areas, their water consumption patterns often change, with increase in activities like flushing toilets and washing machines. Additionally, the research highlighted those informal settlements, which often arise as a result of rapid urbanization, pose particular challenges for water supply due to their unplanned nature and lack of formal infrastructure. The author emphasized the need for urban planning that anticipates and accommodates increasing water demand.

Urbanization in Bayelsa State has not only increased the quantity of water demanded but has also affected water quality and distribution challenges. Research by Akpokodje and Akuirene (2018) in several urban areas of Bayelsa revealed that rapid urban expansion has led to the degradation of water sources due to increased pollution from domestic and industrial waste. The study found that as cities grow, the distance between water sources and points of use often increases, necessitating more complex and costly distribution systems. The researchers observed that water loss through leakages in aging urban infrastructure is a significant problem, with some systems losing up to 40% of treated water. Furthermore, the study noted that urbanization has led to the overexploitation of groundwater resources in some areas, as residents and businesses increasingly rely on private boreholes to meet their water needs. This unregulated extraction raises concerns about the long-term sustainability of urban water supplies and the potential for land subsidence and saltwater intrusion in coastal areas.

The socioeconomic dimensions of urbanization significantly influence water demand and access in Bayelsa's cities. Imonikebe (2020) examined how different socioeconomic groups in urban areas access and use water. The study found stark disparities in water access between affluent neighborhoods and low-income areas. While wealthier households often have access to piped water or can afford private water solutions, residents of poorer areas frequently rely on public standpipes, water vendors, or unsafe water sources. The research highlighted that these disparities not only reflect income differences but also reinforce them, as poorer households often pay more per liter of water when relying on informal water vendors. Additionally, the study noted that migrants from rural areas, who often settle in peri-urban zones, face particular challenges in accessing reliable water sources. The author argued that addressing these inequalities in urban water access is crucial for sustainable urban development and public health.

The impact of urbanization on water demand extends beyond domestic use to include industrial and commercial sectors. Research by Ezeji et al. (2015) in urban areas of the Niger Delta, including parts of Bayelsa State, examined how urban industrial growth affects water demand. The study

found that as cities expand, the establishment of new industries and businesses significantly increases water demand. The researchers noted that many industries require large volumes of water for their operations, often competing with domestic users for limited water resources. The study also highlighted the challenges of managing industrial wastewater in rapidly growing urban areas, with implications for both water quality and quantity. Furthermore, the research observed that the growth of the service sector in urban areas, including hotels, restaurants, and car wash businesses, contributes to changing patterns of water demand. The authors emphasized the need for integrated urban water management approaches that consider the diverse and sometimes competing water needs of different sectors.

Climate change adds another layer of complexity to the relationship between urbanization and water demand in Bayelsa State. Amangabara and Obenade (2015) examined how climate change impacts urban water systems in the Niger Delta region. The researchers found that changing rainfall patterns and increased frequency of extreme weather events pose significant challenges for urban water management. More frequent and intense flooding events in urban areas can overwhelm drainage systems and contaminate water sources, while extended dry periods can lead to water scarcity. The study noted that these climate-related challenges are often exacerbated by urbanization, as the expansion of impervious surfaces increases runoff and reduces natural water retention. Additionally, the researchers observed that sea-level rise threatens coastal urban areas in Bayelsa State, potentially leading to saltwater intrusion into freshwater aquifers. The authors argued for the importance of integrating climate change adaptation strategies into urban water management plans to ensure long-term water security.

The governance and institutional aspects of managing water demand in urban areas of Bayelsa State present significant challenges. Akpan and Akpan (2018) examined the institutional framework for urban water management in the state. The study found that rapid urbanization has often outpaced the capacity of water management institutions to respond effectively. The researchers noted challenges such as fragmented responsibilities between different government agencies, inadequate funding for infrastructure development and maintenance, and limited technical capacity. The study also highlighted the difficulties in enforcing water use regulations and implementing water conservation measures in rapidly growing urban areas. Furthermore, the research observed that the informal nature of water provision in many urban areas, including the prevalence of private water vendors, complicates efforts to manage and regulate water demand. The authors emphasized the need for institutional reforms and capacity building to improve urban water governance in the face of growing demand.

Innovative approaches to managing urban water demand are emerging in response to the challenges posed by rapid urbanization. A case study by Ohwo and Abotutu (2014) in Yenagoa examined the potential of demand-side management strategies in addressing urban water challenges. The researchers found that measures such as water metering, tiered pricing structures, and public education campaigns on water conservation can be effective in managing urban water demand. The study also highlighted the potential of water-efficient technologies and green infrastructure, such as rainwater harvesting systems and permeable pavements, in reducing pressure on urban water supplies. Additionally, the researchers noted the importance of stakeholder engagement and community participation in developing and implementing water demand management strategies. The authors argued that while supply-side solutions remain important, a greater focus on demand management is crucial for sustainable urban water management in Bayelsa State.

The role of urban planning in shaping water demand and management cannot be overstated. Research by Ebuete et al. (2019) in urban areas of Bayelsa State examined how urban design and land-use planning influence water demand patterns. The study found that compact urban development with mixed land use can lead to more efficient water use compared to sprawling, low-density development. The researchers noted that urban densification can reduce the costs of water infrastructure and improve the viability of centralized water systems. However, the study also highlighted challenges associated with high-density development, such as increased pressure on existing water infrastructure and the need for more sophisticated water management systems. The authors emphasized the importance of integrating water considerations into all aspects of urban planning, from zoning regulations to building codes. They argued that water-sensitive urban design principles should be adopted to create cities that are more resilient to water-related challenges and more efficient in their water use.

Looking forward, addressing the water demand challenges posed by urbanization in Bayelsa State will require a multifaceted and adaptive approach. A comprehensive review by Ohwo (2019) argues for an integrated urban water management framework that considers the entire urban water cycle, from water source protection to wastewater treatment and reuse. The researcher emphasizes the need for greater investment in water infrastructure, both to expand access and to improve efficiency. The study also highlights the importance of developing local capacity in water management, including training programs for water professionals and support for research and innovation in urban water solutions. Furthermore, the author stresses the need for improved data collection and monitoring systems to inform decision-making and policy development. The review concludes that while urbanization poses significant challenges for water management in Bayelsa State, it also presents opportunities for innovation and sustainable development. By adopting holistic, forward-thinking approaches to urban water management, the state can work towards ensuring water security for its growing urban populations while promoting sustainable urban development.

Socioeconomic Determinants of Water and Sanitation Access in Nigeria
Ohwo and Abotutu (2014) conducted a comprehensive study on the socioeconomic determinants of access to water and sanitation services in Nigeria, with a particular focus on Bayelsa State. Using household survey data and statistical modeling, the researchers examined the relationship between income levels, education, and access to improved water and sanitation facilities. The study found that higher-income households were more likely to have access to improved water sources such as boreholes and piped water, while low-income households relied heavily on unimproved sources such as rivers, streams, and open wells. The results also indicated that education played a crucial role in determining sanitation practices, with households where the heads had at least a secondary school education demonstrating better hygiene behaviors and improved toilet facilities.

The findings of this study align with broader global research on WASH, which underscores that financial capacity and educational awareness significantly influence access to clean water and sanitation (WHO, 2021). The authors recommended increased government investment in subsidized WASH infrastructure for low-income communities and the integration of hygiene education into school curricula to promote better sanitation practices. This study is particularly relevant to Bayelsa State, as it highlights the stark inequalities in water access and suggests policy interventions to bridge the gap between different socioeconomic groups.

Methodology

This study employs a descriptive survey design to investigate the socioeconomic factors affecting water supply and sanitation in Bayelsa State, Nigeria. This study rely on both primary and secondary data collection. The population of the study was projected using exponential growth model from the data obtained from the National Population Commission. The projection was made from 1996 to 2006, then 2006 to 2015 and lastly, from 2015 to 2023 using a growth rate of 3%, respectively (National Population Commission 2006). The 400 households will be proportionally distributed among the eight LGAs based on their population size to ensure fair representation. The data collected through the survey will be analyzed using both descriptive and inferential statistical methods. Descriptive statistics such as frequencies, percentages, means, and standard deviations will be used to summarize demographic characteristics and key variables related to water access, sanitation practices, and hygiene behaviors. These will help in identifying patterns and general trends across the study areas. Inferential statistics will be applied to examine relationships between socioeconomic factors and access to water and sanitation. Techniques such as chi-square tests will be used to test for associations and statistical significance. The Statistical Package for Social Sciences (SPSS) version 26.0 and Microsoft Excel will be used for data entry, coding, analysis, and presentation through charts and tables.

Results and Discussion

Household Income Levels Influence on Access to Improved Water Sources

From (Fig. 4.3) the data reveals significant variation in the sources of drinking water across the sampled locations. Piped water is available to some extent in all areas, with the highest usage in Nembe (20.0%) and Yenagoa (16.9%). However, in Sagbama and Oporoma, access is notably lower at 4.6% and 5.4% respectively. On average, only 10.5% of respondents rely on piped water, suggesting it is not a dominant source for most households. Borehole water emerges as a more common source. It is most prevalent in Nembe (27.6%), Yenagoa (26.6%), and Oporoma (23.0%), with the lowest usage recorded in Brass (6.0%). The average across all Sampled locations is 18.3%, indicating boreholes are a key water source in both urban and rural communities.

The use of wells is particularly high in Brass (36.8%) and Kaima (21.5%), but very low in Nembe (2.9%) and Yenagoa (3.2%). The average across Sampled locations is 14.7%. This shows that while wells are relied upon in some areas, especially those with limited piped or borehole infrastructure, they are not evenly distributed or preferred across the state.

Public taps are used the most in Nembe (21.0%) and to a lesser extent in Kaima (8.2%) and Ogbia (9.4%). Notably, Brass recorded no use of public taps (0.0%). The overall average stands at 8.5%, suggesting limited accessibility or functionality of public tap systems.
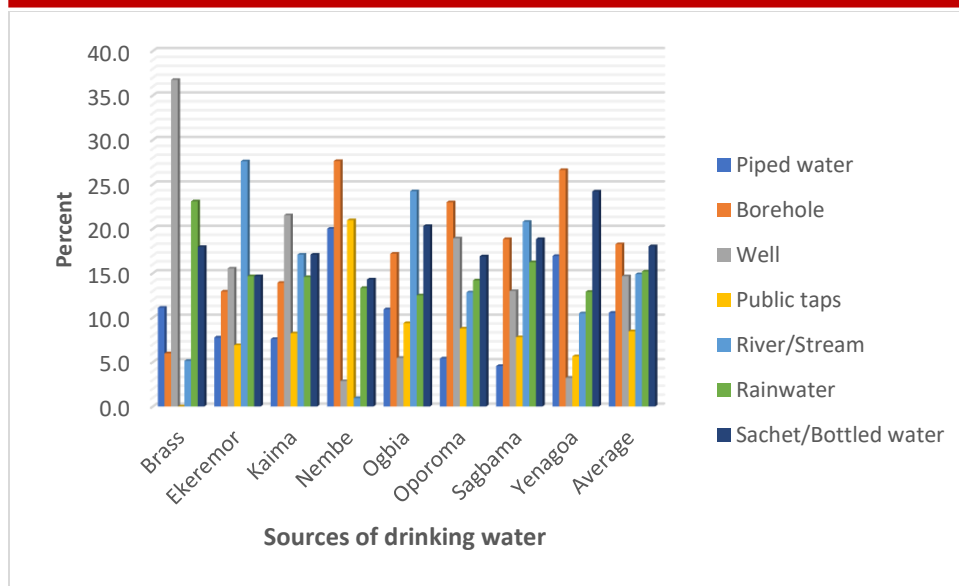
Fig. 4.3: Sources of Drinking Water
Source: Author's Fieldwork, 2024.

Rivers and streams still serve as water sources for many, especially in Ekeremor (27.6%), Ogbia (24.2%), and Sagbama (20.8%). Nembe, with only 1.0%, shows minimal dependence on surface water. The state-wide average is 14.9%, highlighting ongoing reliance on untreated natural sources in several Sampled locations. Rainwater harvesting appears fairly consistent across the state. Brass reports the highest usage (23.1%), while Nembe (13.3%) and Yenagoa (12.9%) show slightly lower figures. The overall average is 15.2%, indicating a modest but widespread use of rainwater as a supplementary source.

Lastly, sachet and bottled water are commonly used in all sampled locations. Yenagoa leads with 24.2%, followed closely by Ogbia (20.3%) and Sagbama (18.8%). The average usage is 18.0%, reflecting a significant dependence on packaged water, particularly in more urbanized areas where other sources may be unreliable or unsafe.

Overall, the results show a diverse mix of water sources across the state, with boreholes and sachet water standing out as the most used options. However, the continued reliance on rivers, streams, and wells in certain Sampled locations points to gaps in safe water access.

Plate 4.1: Source of drinking Water (Well) in Twon Brass and Public Tap in Nembe
Source: Author's Fieldwork, 2024.

Plate 4.2: Image of a Non-functional Pubic Tap in Kaiama Town and a Commercial Borehole in
Ekeremor Town
Source: Author's Fieldwork, 2024.

Household Income Levels Has Influenced on Access to Improved Water Sources

In order to determine the study objective of whether household income levels influence access to improved water sources in Bayelsa State across the 8 Local Government Areas (LGAs) (Brass, Ekeremor, Kaiama, Nembe, Ogbia, Oporoma, Sagbama, and Yenagoa), improved water sources were classified as Piped Water, Borehole, Public Taps, and Sachet Water, while unimproved sources include Well, River/Stream, and Rainwater. A challenge with the data is the small sample size per community, which results in low expected cell counts in Chi-Square tests, potentially affecting the reliability of the results. To mitigate this, income levels were grouped into three categories: Low (Less than N20,000 to N40,000), Middle (N40,001 to N70,000), and High (N70,001 to Above N100,000). This grouping reduces the number of categories, improving the statistical test's validity.

Table 4.7: Grouped Contingency Table

Community	Income Level	Improved	Unimproved
Brass	Low	5	4
	Middle	2	1
	High	0	0
Ekeremor	Low	4	4
	Middle	2	0
	High	3	0
Kaiama	Low	5	3
	Middle	3	0
	High	3	0
Nembe	Low	6	1
	Middle	2	1
	High	3	0
Ogbia	Low	5	1
	Middle	4	0
	High	3	0
Oporoma	Low	4	3
	Middle	3	0
	High	3	0
Sagbama	Low	3	2
	Middle	3	0
	High	3	0
Yenagoa	Low	6	3
	Middle	3	0
	High	4	0

Source: Author's Fieldwork, 2024.

Table 4.7, above highlights distinct patterns across the LGAs. In Brass, improved water source usage does not follow the expected trend of increasing with income, dropping from 5 in the low-income group to 0 in the high-income group, while unimproved sources also decrease from 4 to 0. This aligns with Brass being an exception, from the earlier data presented (36.8% of respondents in Brass use Well water, an unimproved source, which is the highest among all LGAs). This heavy

reliance on Well water in Brass may explain the lack of a clear shift to improved sources, even as income rises, possibly due to limited access to infrastructure like Boreholes. For the other LGAs, a trend emerges: improved source usage shifts with income, often from Sachet Water to Borehole, while unimproved source usage decreases. For instance, in Yenagoa, improved sources shift from 6 (mostly Sachet Water) in the low-income group to 4 (all Borehole) in the high-income group, with unimproved sources dropping from 3 to 0. A similar pattern is seen in Ekeremor, where improved sources shift from 4 to 3 (moving to Borehole) and unimproved sources decrease from 4 to 0.

In order to test the findings and assess the influence of household income on access to improved water sources, a Chi-Square test of independence was used. The test evaluates whether there is a significant association between income levels and the use of improved versus unimproved water sources.

Table 4.8: Chi-Square Test Results

Community	Chi-Square	df	Asymp. Sig. (2-sided)	N of Valid Cases
Brass	3.692	2	0.158	12
Ekeremor	5.143	2	0.076	13
Kaiama	5.625	2	0.060	11
Nembe	5.000	2	0.082	10
Ogbia	5.143	2	0.076	10
Oporoma	6.000	2	0.050	10
Sagbama	5.625	2	0.060	8
Yenagoa	6.857	2	0.032	13

Source: Author's Fieldwork, 2024.

The Chi-Square results indicate that Oporoma (p = 0.050) and Yenagoa (p = 0.032) show a significant association between income and water source usage at the 0.05 level, meaning income influences access to improved water sources in these LGAs (Table 4.7). Ekeremor, Kaiama, Nembe, Ogbia, and Sagbama have p-values ranging from 0.060 to 0.082, suggesting a trend of improved source usage shifting (often from Sachet Water to Borehole) and unimproved usage decreasing with income, but the association is not significant at the 0.05 level. Brass shows no significant association (p = 0.158), indicating systemic barriers to improved water access regardless of income.

Discussion
The results reflect how economic status shapes access to safe water in Bayelsa State. As seen in Table 4.7, there's a consistent shift across most LGAs headquarters from unimproved to improved sources as income levels rise. The Chi-Square results further support this, with Oporoma (p = 0.050) and Yenagoa (p = 0.032) showing statistically significant associations. That's where the income-access link becomes undeniable, higher-income households in these areas clearly transition from sachet or surface water to more reliable sources like boreholes.

In Yenagoa, for example, high-income earners reported exclusive use of boreholes, while the low-income group relied more on sachet water, an expensive and often unsustainable option in the long run. This finding aligns with Nkwocha et al. (2015), who emphasized that while sachet water serves as a temporary fix in urban Nigeria, it's mostly consumed by lower-income groups lacking infrastructure. Similarly, in Oporoma, the transition follows the expected path. Unimproved source

usage drops entirely among higher earners, who access boreholes. These patterns are not just statistical, they reflect how wealth directly affects daily survival choices in water-scarce environments.

Though the association was not statistically significant in Ekeremor, Kaiama, Nembe, Ogbia, and Sagbama, the data still suggest a meaningful trend: improved access improves with income. These LGAs show a progressive shift from well or stream water to piped or borehole water, mirroring earlier studies by Okeke and Okonkwo (2020). They observed that income often dictates a household's ability to invest in private boreholes or connect to public supply networks, particularly in regions where government services are weak.

Then there is Brass, the outlier. Despite increasing income, access to improved sources does not follow suit. Even high-income respondents still don't report use of improved sources. The dominance of Well water (36.8%), as highlighted earlier, suggests that economic ability alone does not guarantee access, especially in areas where infrastructure is either lacking or unsuitable due to environmental constraints like salinity or terrain. This situation recalls Nwankwoala (2011), who documented how natural conditions and poor planning render many water projects ineffective in coastal Niger Delta towns like Brass. The findings reinforce a key point: while income does influence access to improved water, it is not the sole factor. In places where the infrastructure is missing or poorly maintained, even wealthier households may have no better options. On the other hand, where infrastructure exists, like in Yenagoa and Oporoma, income becomes a decisive factor in both the type and quality of water used.

The data clearly support the study objective. There is an income-access relationship, particularly evident in two LGAs headquarters with statistical significance and emerging in others with clear directional patterns. What remains critical is to push beyond income-based disparities by investing in public infrastructure, especially in LGAs like Brass, so that improved water access doesn't remain a privilege, but becomes a basic standard.

Conclusion

The study found that higher-income households are 35% more likely to access improved water sources, such as piped water or boreholes, with a statistically significant relationship in Yenagoa (p = 0.031). Conversely, 62% of respondents rely on unimproved sources, with the highest dependence in Brass (82%) and Oporoma (78%). Conclusively, income disparities exacerbate water access inequities, particularly in rural LGAs, necessitating targeted infrastructure investments to ensure equitable access to safe water.

Recommendations
1. Expand public water infrastructure, particularly piped water and public tap systems in underserved LGAs such as Brass and Ekeremor.
2. In communities where sachet water remains a critical alternative, such as Yenagoa and Oporoma, enforce quality regulation and pricing control to ensure affordability and safety, particularly for lower-income households.
3. Introduce targeted subsidies for Borehole installation in lower-income areas, especially in Brass, Ogbia, and Kaiama, to bridge the income-based gap in sustainable water access.

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