



OPEN Examining awareness, implementation, and challenges of sustainable development goal 6 in rural Osun State, Nigeria

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As the global community intensifies efforts to achieve the Sustainable Development Goals (SDGs) by 2030, this study examines the awareness, implementation, and challenges of SDG 6 in rural communities of Osun West Senatorial District, Osun State, Nigeria. A multi-stage sampling technique was used to select 31 communities across 10 local government areas (LGAs), with three communities per LGA, resulting in a total of 310 surveyed households. Data collection involved two structured questionnaires focusing on water access and sanitation, supplemented by field observations. Descriptive analysis revealed that 82.8% of respondents were female, while 79.57% earned below the national minimum wage of ₦70,000 (approximately \$47). Additionally, 49.46% relied on surface and groundwater sources for drinking water, and 63.44% practiced open defecation, highlighting critical sanitation challenges. Findings further showed that 20 (61.29%) of the communities did not benefit from Millennium Development Goal (MDG) water projects, and among the 11 villages with such projects, only five had functional water facilities, indicating inadequate implementation and maintenance. Factorability tests of the datasets yielded Kaiser–Meyer–Olkin (KMO) values of 60.2% and 77.5% for water access and sanitation facilities, respectively, both significant at $p < 0.005$. Factor analysis (FA) identified four key variables influencing awareness of SDG 6 (clean water component), explaining 71.22% of the total variance. People's belief in water as a communal and non-exclusive resource accounted for the highest variance (24.62%) with an Eigenvalue of 2.216. Similarly, three key factors explained 75.8% of the total variance in respondents' awareness of SDG 6 (sanitation component), with the lack of household sanitation facilities contributing the most (41.27%) and an Eigenvalue of 2.889. The study underscores the urgent need for targeted awareness campaigns, stronger community engagement, and sustainable policy interventions to improve access to clean water and proper sanitation. Strengthening institutional support and fostering behavioural change are critical to ensuring the successful implementation of SDG 6 in rural Nigeria. Further research in other regions is recommended to enhance the understanding of SDG 6 implementation among rural populations.

Keywords Awareness, Osun State, Nigeria, Rural communities, SDG 6, Water, Sanitation

The global community is actively working towards fast-tracking the actualisation of the 17 Sustainable Development Goals (SDGs), which are expected to be achieved by 2030. The SDGs were introduced as a continuation of the Millennium Development Goals (MDGs) to sustain and build upon the progress made during the 15-year MDG period (2001–2015). Implementation of various SDGs, including SDG 6, which focuses on 'Access to Clean Water and Sanitation', commenced after the expiration of the MDGs in 2015. The seventeen SDGs, covering multiple aspects of human development, were designed to guide the global community towards sustainable progress. The concept of 'sustainability' entails continuous maintenance to prevent deterioration, thereby ensuring human well-being and environmental stability. These goals were established with the intention of safeguarding human existence on Earth. Examples of SDGs include SDG 1 (Food Security), SDG 2 (Poverty Alleviation), and SDG 6 (Clean Water Access and Sanitation), among others.

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While the implementation of the SDGs has been vigorously pursued in developed nations, progress in developing countries remains significantly low^{1–3}. Poor implementation in many countries is often attributed to dilapidated MDG-era infrastructure^{4,5}, a situation that could jeopardise human sustenance by 2030. Many developing nations face political, economic, and social challenges that hinder the achievement of the SDGs^{6,7}. For instance, the African Development Bank (AfDB)⁸ reported that economic recessions in African countries like Kenya, Uganda, and Chad, among others have affected the provision of counterpart funding needed for executing various SDG programmes. Additionally, widespread corruption and fund misappropriation in West African countries such as Nigeria, Liberia, and Cameroon have led to the abandonment of numerous SDG projects in both urban and rural areas^{9,10}.

The shift from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs) marked a significant evolution in the global water and sanitation agenda¹¹. MDG 7, specifically Target 7.C, aimed to halve the proportion of people without access to safe drinking water and basic sanitation by 2015. While this led to the development of water infrastructure in many rural communities, including parts of Nigeria, the focus was largely on expanding access rather than ensuring sustainability or long-term functionality. As a result, many MDG-era projects, such as boreholes and handpumps, have become non-functional due to poor maintenance and limited community involvement¹².

In contrast, SDG 6 adopts a more comprehensive approach by aiming for universal access to safe, affordable, and sustainable water and sanitation by 2030¹³. It emphasizes water quality, efficiency, integrated resource management, and equity, including the needs of vulnerable populations¹⁴. However, the legacy of inadequate MDG infrastructure continues to hinder progress^{15,16}, particularly in rural areas like Osun State. This context is essential for understanding the current levels of awareness, the implementation status, and the challenges facing efforts to achieve SDG 6 in these communities.

Since Nigeria committed to the SDGs in 2016, various initiatives have been implemented to improve water supply, sanitation, and hygiene (WASH) services across the country. The government has introduced policies such as the National Action Plan for the Revitalisation of the Water, Sanitation and Hygiene Sector (2018) and the Clean Nigeria: Use the Toilet Campaign, which have contributed to some improvements, particularly in urban and peri-urban areas¹⁷. Additionally, partnerships with international organisations, including the United Nations Children's Fund (UNICEF), the World Bank, and non-governmental organisations (NGOs), have supported the expansion of water infrastructure and hygiene awareness programmes. Despite these efforts, significant challenges persist, especially in Nigeria's rural communities.

One of the key areas of progress is the increased access to improved water sources in some regions¹⁸. The launch of the Partnership for Expanded Water Supply, Sanitation and Hygiene (PEWASH) has played a role in extending water infrastructure to underserved areas. This initiative focuses on increasing access to safe drinking water through the construction of boreholes, small-scale water supply systems, and community-led sanitation programmes^{19,20}. Some states have also taken steps towards eliminating open defecation, with growing commitments to achieving open-defecation-free (ODF) status. Awareness campaigns and advocacy efforts have helped educate communities on the importance of hygiene and safe water storage, contributing to behavioural changes in certain areas²¹.

However, rural areas in Nigeria continue to face significant challenges in achieving SDG 6, primarily due to inadequate funding for WASH projects, which makes infrastructure development costly and difficult to sustain. Many communities still depend on unprotected water sources such as rivers, streams, and wells, resulting in frequent outbreaks of waterborne diseases like cholera and typhoid. Poor sanitation coverage further exacerbates the problem, as access to improved toilets and proper waste management remains limited. Weak policy enforcement and governance issues hinder progress, with many initiatives suffering from poor implementation and a lack of accountability¹⁹. Additionally, climate change-related challenges, including droughts, flooding, and seasonal variations in water availability, further threaten the sustainability of clean water access in these regions²². Rural communities are particularly vulnerable due to their poor infrastructure and inadequate access to essential services such as healthcare, education, and potable water^{23,24}. Consequently, waterborne diseases and related health issues are more prevalent in these areas^{25,26}. Thus, addressing these challenges through effective implementation of SDG 6 could significantly improve water access and sanitation services, enhancing public health and overall well-being in rural Nigeria.

Although some progress in water access was made in Nigeria under the MDGs, sustaining these achievements through the implementation of SDG 6 is crucial^{18,27}. However, the discontinuation of mini-water schemes in Osun State raises concerns about the accessibility of clean water in rural areas. In Osun State, Nigeria, various mini-water schemes initiated by the state government have become moribund due to different challenges including aging infrastructure, lack of timely maintenance and poor funding, among others. Examples of such mini-water schemes include those in Ejigbo, Iwo, Ife-Odan, Olupona, all in Osun west senatorial district, among others found across the length and breadth of the state (State of Osun, 2020).

It is therefore essential to assess the level of SDG 6 implementation in these regions to determine whether the programme has effectively reached rural communities.

This research aims to investigate the awareness and perception of SDG 6 among rural dwellers in Osun State, Nigeria. The specific objectives are to: (i) examine the presence of MDG-era water and sanitation projects in rural Osun State; (ii) assess the level of awareness of SDG 6 among rural residents; and (iii) evaluate rural dwellers' perceptions of SDG 6 to understand their knowledge, attitudes, and engagement with the initiative. By exploring these aspects, the study seeks to identify gaps and areas requiring further intervention to achieve universal access to safe water and sanitation by 2030. Additionally, this research will assess the long-term impact of MDG 7, which previously encompassed water access initiatives, in rural Osun State. It will also examine the sustainability of past and present projects, focusing on maintenance efforts and the potential for resuscitating defunct infrastructure.

Addressing these concerns is crucial to overcoming the challenges associated with SDG 6 implementation. Identifying practical solutions to these challenges is the only way to enhance human sustainability globally, particularly in the rural communities of developing countries.

Theoretical framework

This study integrates multiple theoretical perspectives to explain the factors influencing awareness, adoption, and implementation of SDG 6 in rural communities. These include the Diffusion of Innovations Theory, Sociocultural Theory, Health Belief Model (HBM), and Environmental Determinism Theory.

The Diffusion of Innovations Theory explains how new ideas and technologies spread within a society. The adoption of SDG 6—encompassing improved water and sanitation practices—relies on awareness, perceived benefits, and available communication channels. Low awareness in rural communities suggests ineffective information dissemination due to limited education, weak government engagement, and inadequate advocacy. The theory categorizes individuals into innovators, early adopters, early majority, late majority, and laggards. In rural Osun State, most people belong to the late majority or laggards, necessitating strategic interventions for gradual adoption. Opinion leaders—such as community elders, religious figures, and local officials—play a crucial role as change agents in promoting SDG 6 initiatives^{28,29}.

Sociocultural Theory highlights the influence of social interaction, cultural beliefs, and environmental factors on behavior. Many rural communities in Osun West perceive water as an abundant resource, fostering resistance to modern water management. Open defecation persists due to cultural norms and economic constraints. The lack of awareness about SDG 6 is not solely due to information gaps but is also shaped by cultural traditions and communal lifestyles. This theory underscores the need for interventions that align with local customs, integrating education, community participation, and policy enforcement. Social learning is essential, as individuals are more likely to adopt new behaviors when they observe others doing so³⁰. A participatory approach, involving respected community members, can enhance acceptance and behavioural change.

The Health Belief Model (HBM) explains why individuals may or may not adopt behaviour that promote clean water and sanitation. According to this model, health-related decisions are influenced by perceived susceptibility, severity, benefits, and barriers. Many rural dwellers continue using unsafe water sources and practicing open defecation due to low risk perception³¹. Additionally, financial and logistical barriers—such as the cost of household latrines or the difficulty of accessing improved water sources—often outweigh perceived benefits³². Raising awareness through targeted health education and demonstrating tangible benefits can drive behavioural change.

Lastly, Environmental Determinism Theory posits that the physical environment shapes human behaviour and societal development. The availability of natural water sources fosters a perception of water abundance, reducing urgency for modern water solutions. Furthermore, challenging terrains, seasonal water scarcity, and limited infrastructure hinder sanitation development³³. This theory highlights the importance of policies that address geographical constraints while promoting sustainable water and sanitation solutions.

Method of study

Study area

The research was conducted in the 10 local government areas that make up the Osun West Senatorial District (OWSD) of Osun State, Nigeria, situated in the southwestern part of the country (Fig. 1). These are Ede North, Ede South, Egbedore, Ejigbo, Irewole, Isokan, Iwo, Ayedire, Ola-Oluwa, and Aiyedaa. It is geographically positioned between latitude 7°30'N and 8°00'N and longitude 4°00'E and 4°30'E. The area features a mix of undulating plains and low-lying hills, with elevations ranging from 200 to 500 m above sea level. Osun West experiences a tropical climate, with a rainy season from March to October and a dry season from November to February. The district is crisscrossed by several rivers and streams, which are vital for domestic use and agriculture. Farming is the primary occupation for most residents, with crops like cocoa, cassava, maize, yam, and oil palm being widely cultivated. Trading and artisanal activities also play significant roles in the local economy. In some rural areas, animal husbandry and fishing supplement household incomes. Access to water and sanitation facilities varies across the district. Many rural communities depend on rivers, streams, hand-dug wells, and boreholes for water, though water quality and availability are major concerns, especially during the dry season. Sanitation infrastructure is often inadequate, with a significant portion of the population lacking access to improved toilet facilities. Open defecation remains a challenge in some areas due to limited options for hygienic sanitation. Efforts to improve water and sanitation have been hampered by poor infrastructure, financial limitations, and low awareness of sustainable practices.

Sampling technique and sample size

A multi-stage sampling approach was used to arrive at the sample selected. OWSD was selected from the three districts in Osun state, Nigeria, comprising ten (10) local government areas. The selection was based on its accessibility and the time frame for the research. Thirty-one (31) villages were selected randomly from the 10 local government areas (LGAs) in the district (Fig. 2) with an average of three from each LGA. From every village, ten (10) households were chosen, leading to a total sample size of 310 households.

The study primarily targeted female heads of households, as they are responsible for household water collection as reported by Ogunbode et al.²⁰. However, a separate survey was conducted across the entire study area to assess accessibility of respondents to sanitation facilities. Respondent for survey on sanitation facilities access included all adults in the study areas. In households where a female head was unavailable, the male head or the most knowledgeable adult on water and sanitation issues was selected. Figure 3 shows the flow chart on how the sample selected for the survey was obtained.

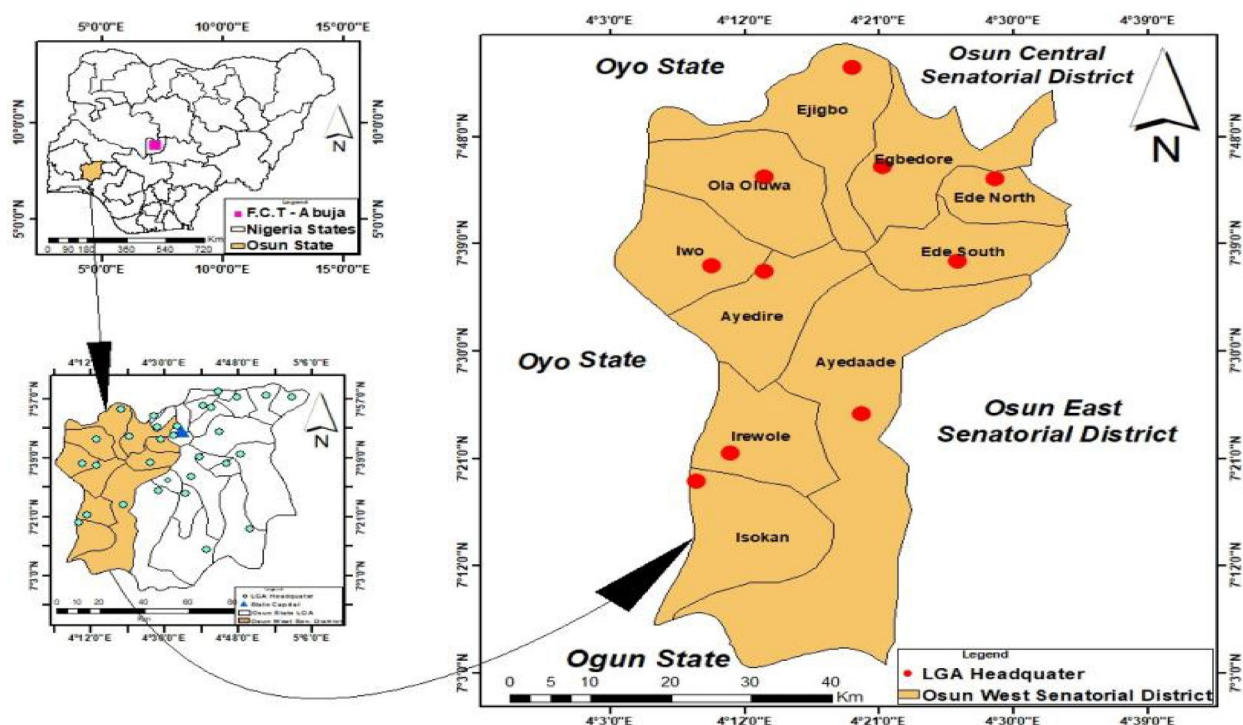


Fig. 1. Map of Nigeria showing Osun State and Osun west senatorial district.

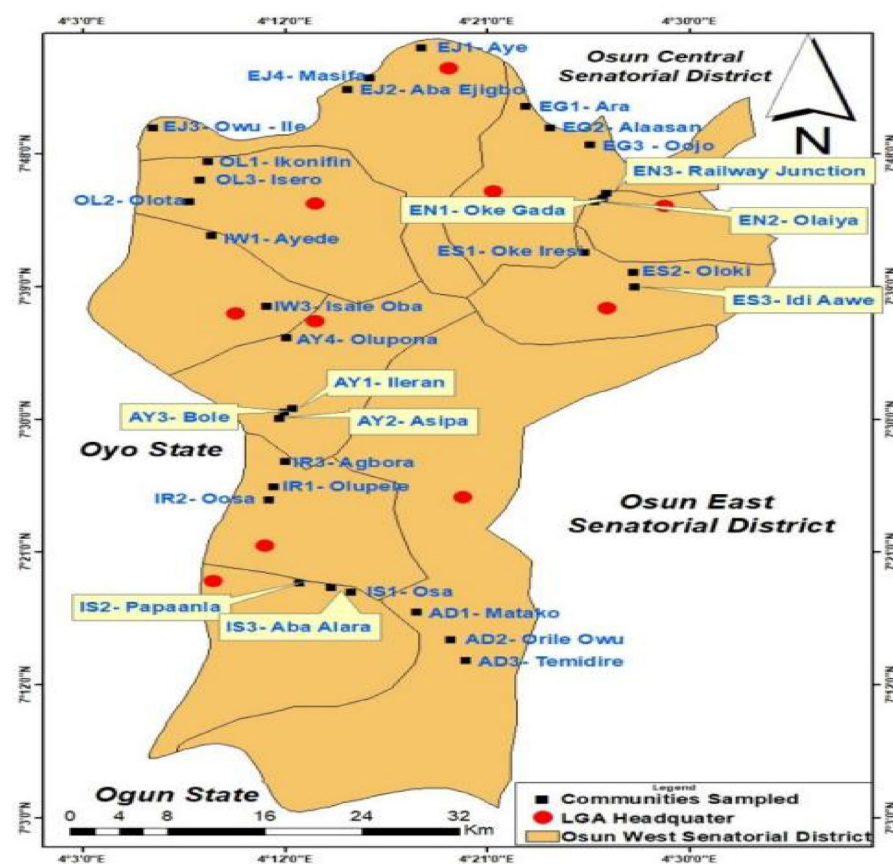


Fig. 2. Osun west senatorial district map showing the rural communities investigated.

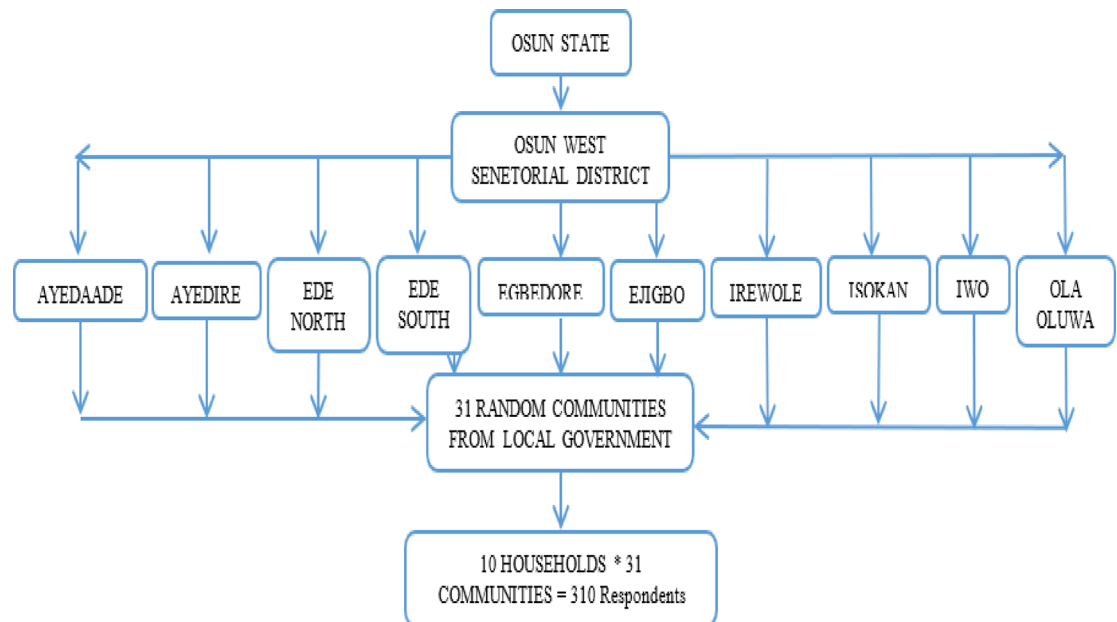


Fig. 3. Flow chart showing step-by-step stages of sample selection.

Data collection methods

Primary data were collected using structured questionnaire and field observations to assess water access, sanitation facilities, and community awareness of SDG 6. Structured questionnaires were administered to female heads of households, with male heads or the most knowledgeable adult responding in their absence, to gather information on awareness of SDG 6, access to clean water, and sanitation practices. Field observations were conducted to assess the condition and functionality of existing water sources and sanitation facilities, particularly the state of motorized boreholes and the prevalence of open defecation. All protocols in the administration of the questionnaire were in accordance with the ethical guidelines as provided by the Bowen University research ethical committee.

Data analysis

The collected data were analyzed using SPSS software. Both descriptive statistics, including pie charts, percentages, and mean values, as well as inferential statistical techniques, specifically factor analysis, were employed to identify significant variables that explain respondents' perceptions of the implementation of water access and sanitation facility targets under SDG 6 of the United Nations.

The use of factor analysis in perception studies is well established. Liu et al.³⁴ and Ogunbode et al.^{20,35,36} extensively applied this method, demonstrating its effectiveness in extracting key variables from large datasets, which form the basis for observed behavioural patterns.

Results and discussion

Basic characteristics of respondents

The basic characteristics of the respondents which comprise their age and gender distribution, income level and among others are discussed and represented in Figs. 3–10.

Gender distribution of respondents

The gender distribution chart (Fig. 3) shows that 82.80% of the respondents were female, while only 17.20% were male. This distribution reflects the study's focus on awareness and understanding of SDG 6 targets among rural dwellers in the study area. Women in rural communities are primarily responsible for household water collection, sanitation, and hygiene, making them the key decision-makers in these areas²⁰. Since they interact more with water sources and sanitation facilities, their awareness and understanding of SDG 6 are crucial for assessing accessibility and challenges. The higher number of female respondents ensures that the study captures relevant insights on water and sanitation issues, as men are often engaged in economic activities outside the home and may have less direct involvement in household water and sanitation management³⁷.

Age range of respondents

The pie chart (Fig. 4) illustrates the age distribution of respondents in the study. A significant portion of the participants falls within the 35–44 (39.78%) and 45–54 (37.63%) age ranges, collectively representing over 77% of the respondents. This indicates that middle-aged adults predominantly hold leadership roles in rural communities, aligning with cultural norms that prioritize experience and seniority in community governance.

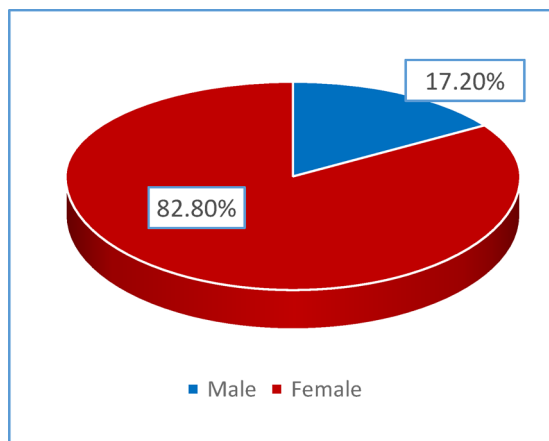


Fig. 4. Respondents' gender distribution.

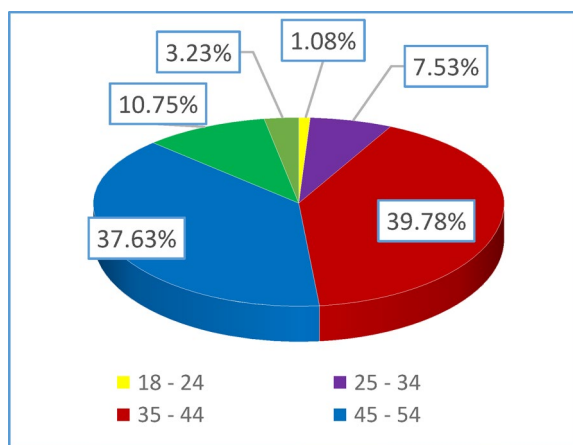


Fig. 5. Age distribution of respondents.

The 55–64 age group accounts for 10.75% of respondents, while 65 and above make up 3.23%, reflecting the involvement of older, more experienced individuals in leadership positions, though to a lesser extent. Younger age groups are minimally represented, with the 25–34 category comprising 7.53% and the 18–24 group only 1.08%, indicating that leadership roles are seldom occupied by younger adults. This age distribution highlights the importance of targeting awareness and educational campaigns toward middle-aged and older adults, who are most influential in decision-making processes within rural communities³⁸.

Respondents level of education

The level of education chart (Fig. 5) indicates that 40.86% of respondents have no formal education, 22.58% attended primary school, 27.96% reached secondary school, and only 8.60% received vocational or technical training. This distribution highlights the limited educational attainment among rural dwellers in the study area, which significantly impacts their awareness and understanding of SDG 6 targets. Education plays a crucial role in shaping knowledge about water sanitation, hygiene, and SDGs³⁹. With a high percentage of respondents lacking formal education, there may be challenges in comprehending the importance of clean water and sanitation initiatives. Lower literacy levels can also hinder access to information about government programs, policies, and best practices related to SDG 6, making awareness campaigns and community engagement essential in improving understanding and promoting behavioral change⁴⁰.

Respondents' level of income

The level of income chart (Fig. 6) reveals that 79.57% of respondents earn less than ₦70,000 (approximately \$47) per month (at \$1 to N1505.70 as at February 19, 2025), which is currently the minimum wage for a Nigerian citizen, while 13.98% earn between ₦70,000 and ₦100,000 (\$47 to \$67), 5.38% earn between ₦100,001 and ₦150,000 (approximately \$67 to \$100), and only 1.08% earn between ₦150,001 and ₦200,000 (\$100 to 133\$). This indicates that most rural dwellers in the study area live below the minimum wage threshold, with many of them engaged in subsistence farming, which provides little financial security. The low-income levels among rural residents contribute to poor sanitation practices, as many households cannot afford to construct proper toilet

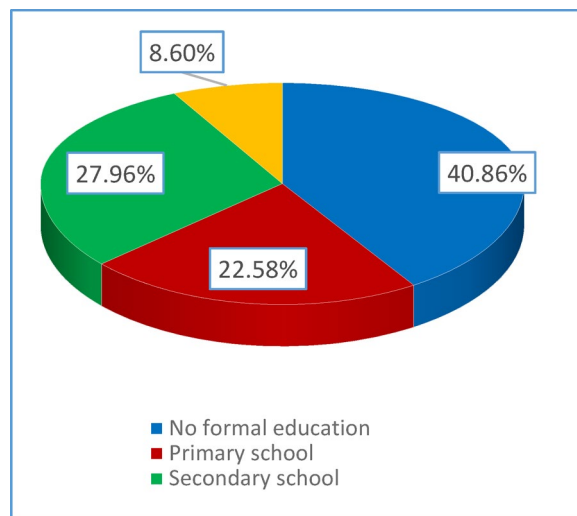


Fig. 6. Respondents' level of education.

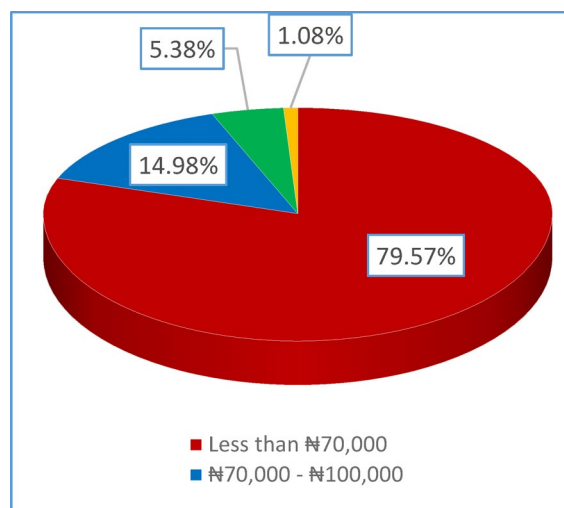


Fig. 7. Monthly income of respondents.

facilities or invest in improved sanitation systems⁴¹. As a result, open defecation becomes a common alternative, further exacerbating health risks and environmental pollution⁴². This financial limitation may also reduce their exposure to awareness campaigns on SDG 6, making it difficult for them to understand the importance of clean water and sanitation in promoting public health and sustainable development⁴³.

Employment status of the respondents

The employment status chart (Fig. 7) shows that 78.49% of the respondents are self-employed, primarily engaged in farming and small-scale businesses, while 5.38% are in full-time employment. Additionally, 10.75% are unemployed, 4.30% are students, and 1.08% are retired. The high proportion of self-employed individuals, coupled with the low percentage of those in formal employment, suggests that many of the respondents rely on irregular income, which limits their ability to invest in improved water and sanitation facilities. This financial constraint has led to continued dependence on unsafe water sources and inadequate sanitation practices, including open defecation⁴⁴. Furthermore, students and unemployed individuals have limited decision-making power within households, affecting their ability to advocate for better water and sanitation resources⁴⁵.

Respondent's sanitation facility

The chart (Fig. 8) shows the distribution of primary sanitation facilities used in households, indicating that 63.44% of respondents practice open defecation, while 20.43% rely on unimproved pit latrines. Only 7.53% use improved pit latrines, and 8.60% have access to flush toilets. The high prevalence of open defecation suggests a severe lack of proper sanitation infrastructure, which can contribute to environmental contamination and

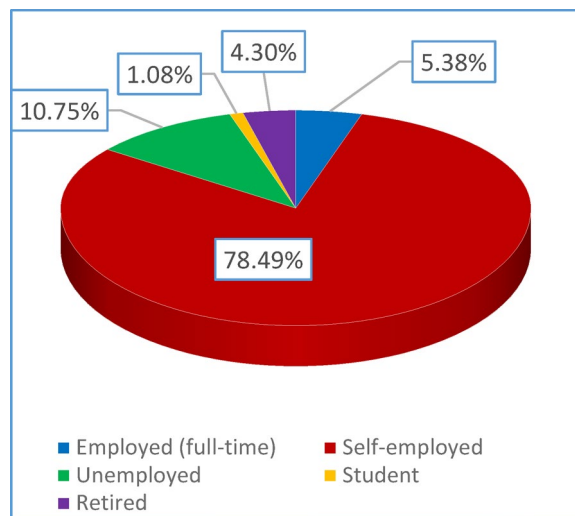


Fig. 8. Employment status of respondents.

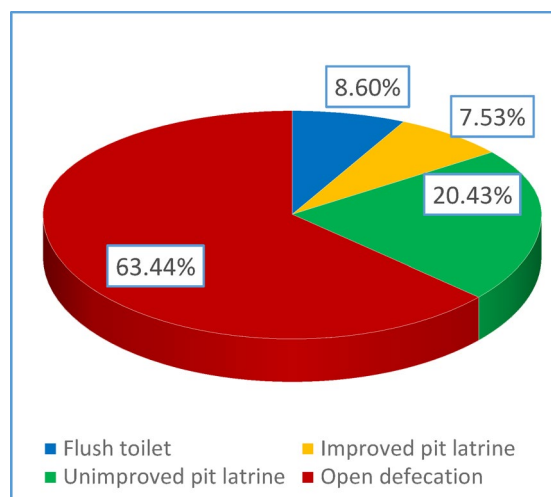


Fig. 9. Sanitation facilities accessed.

health risks, including the spread of waterborne diseases⁴⁶. This situation is influenced by economic limitations, as reflected in the income levels of many in the study area, who primarily engage in subsistence farming with earnings below the national minimum wage. Limited access to clean water sources further exacerbates the issue, making it difficult for communities to maintain proper hygiene³⁶.

Primary source of water for households in the study area

This chart (Fig. 9) illustrates the primary sources of drinking water for households, revealing that 49.46% of respondents depend on motorized boreholes, while 26.88% rely on hand-dug wells. Additionally, 15.05% obtain their drinking water from rivers or streams, and only 8.60% have access to boreholes. A critical issue is that many of the motorized boreholes, which were provided under the MDG projects, are no longer functional in several of the villages in the study area due to poor maintenance and lack of technical expertise. As a result, communities that should have access to improved water sources are left with no choice but to revert to unsafe alternatives^{35,47}. Moreover, cultural and traditional beliefs still influence water consumption habits in many rural areas. Some residents prefer drinking from rivers and streams, believing that these natural water sources possess special qualities or ancestral significance⁴⁸. Unfortunately, these water bodies are often contaminated, exposing communities to waterborne diseases.

Respondents' household size

This chart (Fig. 9) represents household population sizes in the surveyed rural communities. The majority of households (67.74%) have between 5 and 6 occupants, while 21.51% have 3 to 4 occupants, and 10.75% have larger families of 7 to 8 members. The high household population size has significant implications for water and

sanitation access. Larger households require more water for daily activities, increasing the burden on already scarce water sources⁴⁹. With limited access to clean water, families resort to fetching water from unsafe sources such as streams, which raises concerns about waterborne diseases. Additionally, overcrowding in households can strain sanitation facilities. In communities where open defecation is prevalent, larger families may contribute to environmental pollution and health hazards⁵⁰.

MDG water and sanitation projects in the study area

Table 1 reveals a stark imbalance in the distribution of MDG water projects among the communities studied. Out of 31 communities, 20 (61.29%) have no MDG water projects in them while each of the remaining eleven (11) communities has one MDG water project as presented in Fig. 10. However, only five (5) (45.5%) of these existing water projects are operational as at the time of this research. The functioning ones are those in Orile Owu, Owu-Ile, Masifa, Ojo, and Oloki as shown in Fig. 11. The remaining six (6) in Olupona, Alaasan, Ikonifin, Idi Aawe, Osa, and Aba Alara are not functioning. This significant number of non-operational water projects points to serious challenges in infrastructure maintenance and long-term sustainability in water supply in the affected communities^{51,52}.

These findings underscore the urgent need for targeted interventions. Regular assessments, repairs, and increased investments are essential to rehabilitate existing water facilities and expand access to safe water. Improving water infrastructure is not only crucial for public health and sanitation but also for meeting SDG 6—ensuring water availability and sustainable management—by 2030 in rural Osun State (Fig. 12).

Sustainable development goal 6 in the rural area

Accessibility to potable water component

The dataset was subjected to Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test to check for its factorability. The result showed that KMO is 0.602 (60.2%), being significant at $p < 0.005$. Factor

LGA	S/N	VILLAGE	MDG WATER PROJECT	TYPE	PRESENT CONDITION
Ayedaade	1	Matako	Absent	NA	NA
	2	Orile Owu	Present	Powered borehole	F
	3	Temidiire	Absent	NA	NA
Ayedire	4	Ileran	Absent	NA	NA
	5	Asipa	Absent	NA	NA
	6	Bole	Absent	NA	NA
	7	Olupona	Present	Motorized borehole	NF
Ejigbo	8	Aye	Absent	NA	NA
	9	Aba Ejigbo	Absent	NA	NA
	10	Owu-Ile	Present	Motorized borehole	F
	11	Masifa	Present	Motorized borehole	F
Egbedore	12	Ara	Absent	NA	NA
	13	Alaasan	Present	Motorized borehole	NF
	14	Ojo	Present	Motorized borehole	F
Ola-Oluwa	15	Ikonifin	Present	Motorized borehole	NF
	16	Olota	Absent	NA	NA
	17	Isero	Absent	NA	NA
Ede South	18	Oke Iresi	Absent	NA	NA
	19	Oloki	Present	Motorized borehole	F
	20	Idi Aawe	Present	Motorized borehole	NF
Ede North	21	Oke Gada	Absent	NA	NA
	22	Olaiya	Absent	NA	NA
	23	Railway junction	Absent	NA	NA
Irewole	24	Olupele	Absent	NA	NA
	25	Oosa	Absent	NA	NA
	26	Agbora	Absent	NA	NA
Isokan	27	Osa	Present	Motorized borehole	NF
	28	Papaanla	Absent	NA	NA
	29	Aba Alara	Present	Motorized borehole	NF
Iwo	30	Ayede	Absent	NA	NA
	31	Isale Oba	Absent	NA	NA

Table 1. Distribution of MDG projects across the study area. *F* Functional, *NA* Not Available, *NF* Not functional.

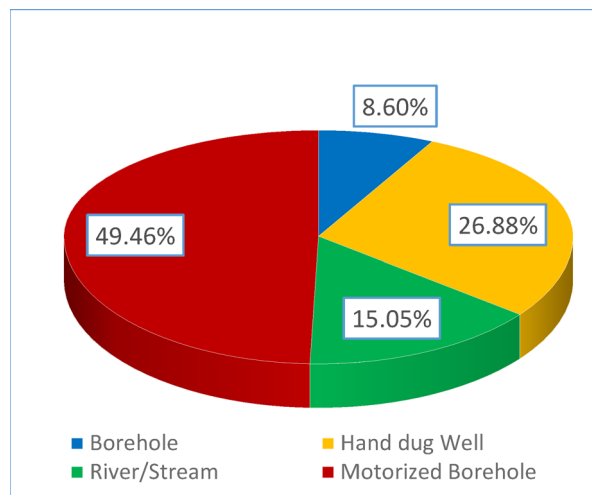


Fig. 10. Primary source of drinking water.

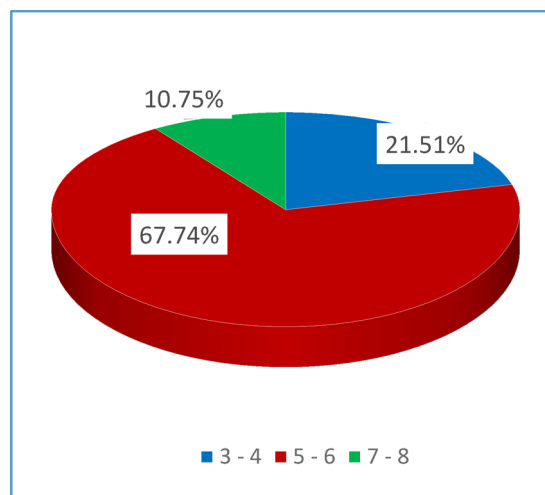


Fig. 11. Household population of respondents.

analysis extracted four (4) variables that explain total variance on respondent's level of awareness of SDG, all of which offered 71.222%. This is represented in Table 2.

The first factor extracted is the respondent's cultural belief and about water as a common resource that any man should not be denied of and so, should not be under any man's control. The variable offered the highest proportion of percentage variance of 24.619 and Eigenvalue of 2.216. Rural dwellers generally do not pay for water services⁵³. Most rural areas depend on surface water sources such as streams and rivers for their household use. As a result, their lack of payment for water supply and related services may contribute to a nonchalant attitude toward unfamiliar programs such as the SDGs. The common belief is that water is a free resource, naturally abundant, and should be accessible to everyone⁴⁷. According to Leal Filho et al.⁵⁴, rural dwellers may be resistant or unwelcoming to any program that challenges their existing beliefs, especially regarding water resource development and accessibility. This aligns with Sociocultural Theory, which emphasizes how traditional beliefs and shared community norms influence behavior. It also reflects Environmental Determinism, as the availability of natural water sources contributes to the perception that water infrastructure is unnecessary (Fig. 13).

The Eigenvalue of 1.812 and variance of 24.619 shows that respondents' level of poverty is a significant factor when it comes to the factors contributing to the awareness of SDGs among rural dwellers. Many rural dwellers prioritize meeting their basic needs, such as food and shelter, over long-term goals like clean water and sanitation^{55,56}. This is largely due to financial constraints that prevent them from investing in improved water systems or sanitation facilities. Consequently, their limited access to information and awareness campaigns makes it more difficult for them to understand the objectives of SDG 6, which seeks to ensure universal access to clean water and sanitation. This supports the Health Belief Model (HBM), as financial and logistical barriers lower the perceived benefit of adopting new behaviors. It also relates to the Diffusion of Innovations Theory

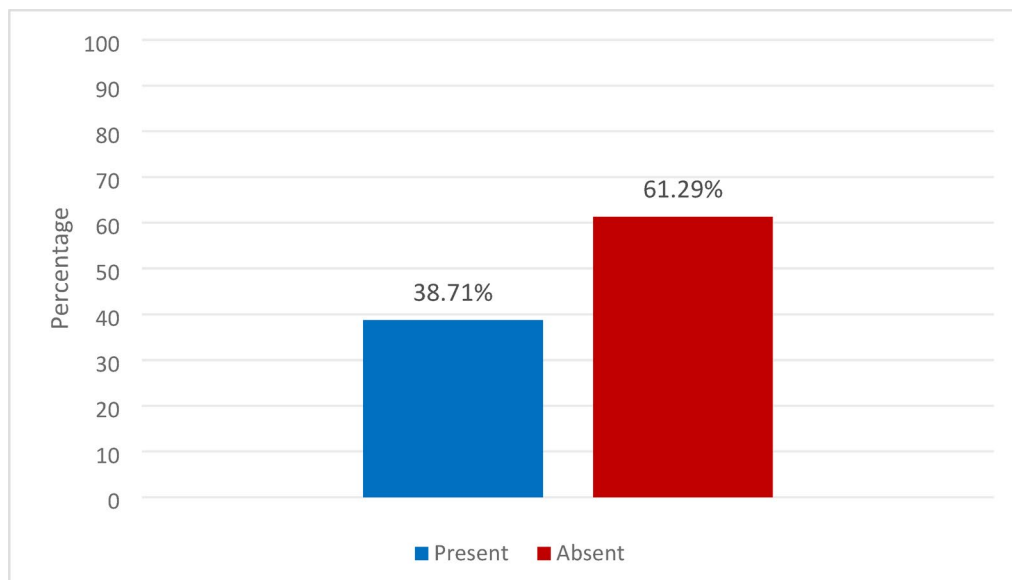


Fig. 12. MDG project availability in communities.

S/N	Variable name	Eigen value	Variance(%)	Variance (Cumulative)
1	Belief in water as a communal and non-exclusive resource	2.216	24.619	24.619
2	Poverty level	1.812	20.134	44.752
3	Poor road connectivity	1.196	13.289	58.041
4	Poor capacity-building for women	1.186	13.181	71.222

Table 2. Factors influencing water accessibility in the study area.

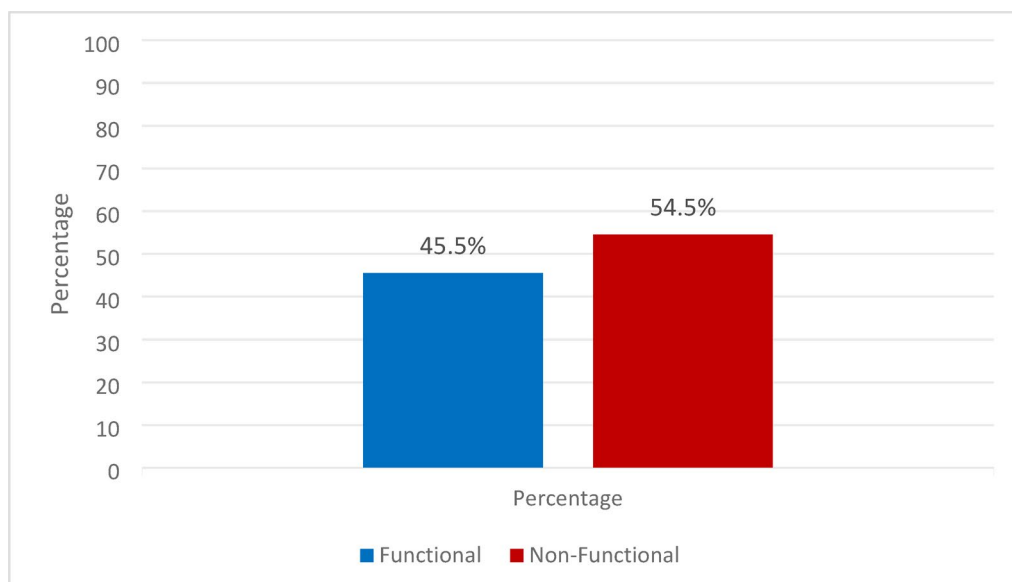


Fig. 13. MDG project functionality in communities.

which explains that poverty limits both exposure to innovations and the resources needed for their adoption, placing rural dwellers among the “late majority” or “laggards.”

Poor connectivity of rural communities has an Eigenvalue of 1.196 and a percentage variance of 13.289. Road infrastructure is generally poor or nonexistent, causing these communities to become physically isolated⁵⁷ and

S/N	Variable name	Eigen value	Variance(%)	Variance (Cumulative)
1	Lack of facilities	2.889	41.265	41.265
2	Population characteristics	1.226	17.512	58.777
3	Ignorance of SDG 6 targets	1.190	16.995	75.773

Table 3. Factors influencing access to sanitation facilities in the study area.

of course, limiting their access to innovative programs, government initiatives and also awareness campaigns related to SDG 6. Organizations and agencies promoting clean water and sanitation often struggle to reach these remote areas due to the lack of reliable transportation routes. As a result, rural dwellers grossly remain unaware of national and global efforts to improve water and sanitation facilities, leaving them excluded from essential information and support⁵⁸. This reflects both Environmental Determinism and Diffusion of Innovations Theories, showing how physical inaccessibility constrains social development and limits the diffusion of knowledge and technologies necessary for SDG 6 adoption.

Poor empowerment programme for women also contributes to low level of rural dwellers' awareness of SDG 6 targets. This is denoted by an Eigenvalue of 1.186 and percentage variance of 13.181. Women are often the primary caregivers responsible for water collection, household hygiene, and sanitation in rural communities^{59,20,60}. However, when women lack empowerment through education, decision-making opportunities, or leadership roles, they have limited access to the knowledge and resources needed to understand and advocate for the goals of SDG 6. Disempowered women often remain trapped in a cycle of poverty and dependence, reducing their ability to demand better water and sanitation facilities or adopt improved practices⁶¹. This lack of empowerment also prevents them from actively participating in community discussions, attending awareness programs, or influencing policies related to water and sanitation, leaving them uninformed about these critical issues. This is backed by the Sociocultural Theory and the Health Belief Model. Sociocultural Theory explains how traditional gender roles constrain women's influence and learning opportunities. HBM emphasizes that perceived barriers like limited autonomy diminish motivation to adopt improved practices or seek knowledge.

SDG 6: accessibility to sanitation component

The dataset was equally subjected to Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test to check for its factorability. The result showed that KMO is 0.775 (77.5%), being significant at $p < 0.005$. Factor analysis extracted three (3) variables that explain total variance on respondent's level of awareness of SDG, all of which offered 75.773%. This is represented in the Table 3.

The first is the lack of sanitation facilities in the respondents' households. The variable offered the highest proportion of percentage variance of 41.265 and Eigenvalue of 2.889. The lack of proper sanitation facilities makes it difficult for community members to understand the goals of SDG 6 and access safe sanitation. Without toilets or other basic sanitation systems, people may not recognize the importance of sanitation for health and well-being, which is a key focus of SDG 6⁶². When there are no visible or functional facilities, sanitation may not seem like a priority, and people may remain unaware of efforts to improve it⁶³. The tradition of defecating in the costless bush and/or designated dump sites within their respective communities may hinder struggles for improved facilities, especially as embedded in SDG 6. This lack of awareness keeps communities trapped in poor sanitation conditions. Environmental Determinism helps explain this trend, as limited infrastructure and physical environmental constraints shape sanitation behavior. The Health Belief Model also applies, as the absence of facilities reduces perceived susceptibility and urgency.

Additionally, the absence of sanitation facilities forces people to rely on unsafe practices like open defecation, increasing the risk of health issues⁶⁴. Women and girls are particularly affected, as inadequate sanitation compromises their safety, dignity, and hygiene^{65,66}. When sanitation remains difficult to access, people may view it as an unattainable luxury rather than a fundamental necessity. This reflects Sociocultural Theory, particularly regarding how traditional gender norms and communal practices perpetuate open defecation despite associated risks.

Population characteristics offers 17.512% in its level of variance and 1.226 as Eigenvalue. The demographic and socioeconomic composition of rural communities plays a crucial role in shaping awareness and accessibility to sanitation. High household sizes increase the demand for water and sanitation facilities, often outpacing available resources and infrastructure⁴⁹. The predominance of farming occupations means that many dwellers spend extended hours in fields, leading to reliance on nearby water sources, which may be unsafe⁶⁷. Furthermore, literacy levels and cultural beliefs significantly influence attitudes toward sanitation and hygiene⁶⁸. In many rural areas, traditional practices and misconceptions about modern sanitation methods contribute to resistance against adopting improved facilities, while gender roles may affect decision-making regarding household water and hygiene priorities. Sociocultural Theory clearly underpins these findings, explaining how demographic realities and cultural learning patterns affect sanitation awareness and practices. Diffusion of Innovations Theory is also relevant where low literacy and occupational commitments reduce exposure to and adoption of improved sanitation behaviors.

An Eigenvalue of 1.190 and variable proportion of 16.995 show that ignorance of SDG 6 targets significantly affects rural dwellers' awareness of SDG 6 and their access to proper sanitation facilities. A lack of awareness and understanding of SDG 6 targets among rural dwellers significantly hinders progress toward achieving clean water and sanitation⁶⁹. Many residents are not familiar with the global and national commitments to improving water access and hygiene, leading to low prioritization of sanitation and safe water practices in their daily lives⁷⁰.

Without proper knowledge, individuals may not recognize the dangers of open defecation, water contamination, or inadequate sanitation facilities, thereby perpetuating harmful practices⁷¹. Additionally, ignorance of available programs and policies supporting water and sanitation improvements can prevent communities from accessing government or non-governmental interventions designed to enhance their living conditions. This is strongly connected to the Diffusion of Innovations Theory, which stresses the importance of communication channels and opinion leaders in disseminating knowledge. It also supports the Health Belief Model where lack of perceived susceptibility, severity, and benefits contributes to continued risky practices.

Implications of the findings

The findings reveal a significant gap in awareness and implementation of SDG 6 among rural dwellers in Osun West Senatorial District, partly linked to uneven distribution and poor continuity of MDG water projects. The low level of familiarity with both MDG 7 and the ongoing SDG 6 initiatives underscores a critical weakness in community engagement which is an essential component of sustainable water and sanitation governance.

This awareness deficit limits the capacity of rural populations to demand accountability, adopt safe practices, and participate in water management efforts. Furthermore, the deterioration of MDG infrastructure, particularly non-functional motorized boreholes, has forced reliance on unsafe surface water. Cultural perceptions of water as a naturally pure and limitless resource further perpetuate this dependence.

Sanitation challenges, notably open defecation, are exacerbated by inadequate infrastructure and behavioral inertia. These conditions not only elevate public health risks but also reinforce gender-based vulnerabilities, especially for women and children.

Taken together, these findings emphasize the urgent need for integrated, context-sensitive interventions. Strategic efforts must target awareness creation, infrastructure rehabilitation, and behavior change, with strong collaboration between government, NGOs, and local communities to advance the goals of SDG 6.

Conclusion and recommendations

This study highlights persistent gaps in awareness, infrastructure, and community engagement concerning SDG 6 among rural populations in Osun West Senatorial District. A history of poorly sustained interventions under the MDGs, combined with low public understanding of SDG 6 targets, continues to hinder access to safe water and adequate sanitation.

To address these challenges, multi-stakeholder approaches are required. Targeted awareness campaigns should be culturally tailored and community-led, involving traditional leaders, faith-based institutions, and local media. Rehabilitating non-functional water facilities and investing in durable, community-managed systems will be crucial for ensuring access to clean water.

Additionally, promoting affordable household sanitation solutions, supported by policy incentives and local capacity-building, can help curb open defecation. Long-term progress will depend on sustained community participation, regular monitoring, and responsive policy implementation. Without these strategic actions, achieving universal access to clean water and sanitation by 2030 will remain elusive for rural communities in Osun State and comparable regions.

Data availability

Data used in this study is available on reasonable request from the corresponding author.

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Author contributions

TOO: Conceptualization, validation, visualization, formal analysis, supervision, writing draft, edit and review;
VOA: Project investigation, formal analysis, writing draft, edit and review;

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Informed consent

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Additional information

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