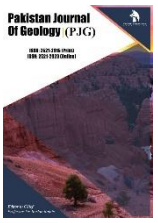
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-2915 (Print)
ISSN: 2521-2923 (Online)
CODEN: PJGABN

Pakistan Journal of Geology (PJG)

DOI: http://doi.org/10.26480/pjg.02.2022.35.39



RESEARCH ARTICLE

EVALUATION OF BOREHOLE INTERVENTION PROJECTS IN IFE CENTRAL LOCAL GOVERNMENT AREA OF OSUN STATE, SOUTHWESTERN NIGERIA

Konwea, C. I.*, Olorunfemi H. K., Ajayi, O.

Department of Geology, Obafemi Awolowo University, Ile-Ife, Nigeria
Corresponding Author Email: onyekonwea@oauife.edu.ng

ARTICLE DETAILS

Article History:

Received 22 May 2022
Accepted 28 June 2022
Available online 07 July 2022

ABSTRACT

The performance of 129 boreholes constructed as groundwater intervention projects by governmental and non-governmental agencies in Ife Central Local Government Area, Osun State, Southwestern Nigeria was assessed to appraise the effectiveness of the projects. Out of the eighty-seven (87) boreholes constructed by Government (Federal, State and Local), 51 boreholes (59%) were functional, while 36 boreholes (41%) were non-functional. Twenty-nine (29) boreholes constructed by non-governmental agencies recorded 66% success and 34% failure. Thirteen (13) boreholes constructed by unidentified agencies recorded 8% success and 92% failure. Pump failure, poor maintenance, stolen pump and unidentified causes contributed 36%, 16%, 7% and 41%, respectively to the 45% failure of the boreholes. The groundwater intervention projects are not very effective as only 55% of the 129 boreholes investigated were functional while 45% were non-functional. Borehole maintenance by both the agencies and beneficiaries, and availability of spare parts for the groundwater supply facilities were recommended.

KEYWORDS

Borehole Failure, Borehole Performance, Government Intervention, Groundwater, Osun State

1. INTRODUCTION

Groundwater is the most reliable source of potable water supply. Groundwater in crystalline basement complex rocks is exploited through boreholes and hand-dug wells; both shallow and deep hand-dug wells (Olorunniwo et al., 2014). Despite the construction of numerous boreholes and hand dug wells in developing countries and the involvement of several agencies in borehole construction and developing groundwater supply facilities, only about 25 - 35% of the rural population and 40 – 45% of the urban population have access to potable water (Agunwamba et al., 2010). The main causes of poor access to potable water include poor feasibilities studies and pre-drilling geophysical investigations, lack of proper operations and maintenance of the groundwater supply facilities and low coverage of water supply facilities (Chima, 2000; Konwea et al., 2020). For instance, most of the boreholes drilled in the rural areas were handed over to the communities without adequate provision of spare parts, training of community operation and maintenance teams and adequate funding for operations and routine maintenance or repairs (Agunwamba et al., 2010). These problems lead ultimately to poor performance and failure of the borehole and associated groundwater supply facilities.

In 2016, failure of water supply facilities cut beneficiaries off access to potable water supply, thereby resulting in 829,000 annual deaths worldwide (WHO, 2021). These people died from illnesses such as diarrhoea and other water related infections. Deaths, arising from lack of potable water, cause about 1.9% of the global burden of disease. Therefore, improved access to potable water should result in the reduction of almost 10% of the total burden of diseases worldwide (WHO, 2021).

One of the objectives of the Millennium Development Goals (MDGs) instituted by the United Nations (UN) was to eradicate the problems associated with lack of access to potable water supply. There are eight (8) MDGs targeted to be achieved between 2000 and 2015. Goal 7 which was to attain environmental sustainability, had a target which was to half the proportion of the global population without access to safe drinking water. As at 2015, the proportion of the global population using an improved drinking water source had increased from 76% to 91%, exceeding the MDGs target, which was met in 2010. Although 2.6 billion people had gained access to improved water source since 1990, eighty percent (80%) of the people living in the rural areas had no access to improved drinking water sources. Hence, the government, non-governmental organizations (NGOs) and private agencies tried to intervene through provision of piped water supply resulting in 1.9 billion people using piped potable water supply in their premises. Over half of the global population (58%) now enjoys this higher level of service. During the same period, the number of people using surface water supply facility fell by more than half, from 346 million to 159 million (WHO and UNICEF, 2021). This is an indication of the drastic shift from surface water to groundwater supply sources for providing potable water to the people.

In 2004, Nigeria had only 48% of its population served by improved water supply, leaving the remaining 52% without adequate or safe drinking water (WHO and UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2006). Nigeria failed to meet the MDGs target of halving the population without access to potable water by the year 2015 despite the interventions by governmental, NGOs and private agencies. The Sustainable Development Goals (SDGs) succeeded the MDGs in September 2015. The Agenda of the SDGs established by the UN has a time frame of 2015 to 2030. The SDGs are a set of seventeen independent goals. Goal six (6) which specifically focuses on water related issues is to "Ensure availability and sustainable water and sanitation for all."

Due to the attendant problems associated with surface water, both the government and NGOs in Nigeria have been involved in providing potable water through groundwater development. The Federal, State and Local Governments have contributed to providing groundwater supply facilities across Nigeria. One of the main NGOs involved in providing groundwater

Quick Response Code	Access this article online	
	Website: www.pakjgeology.com	DOI: 10.26480/pjg.02.2022.35.39

Cite The Article: Konwea, C. I., Olorunfemi H. K., Ajayi, O. (2022). Evaluation of Borehole Intervention Projects in Ife Central Local Government Area of Osun State, Southwestern Nigeria. *Pakistan Journal of Geology, 6(2): 35-39*.

supply facilities in Nigeria is the UN. Some of the UN agencies involved in the water supply sector include the WHO, United Nations International Children Emergency Fund (UNICEF), Joint Monitoring Programme (JMP), Global Expanded Water Monitoring Initiative (GEMI) and the United Nations Water Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS).

1.1 Water Supply in Ife Central Local Government Area

The Ife Central Local Government Area (LGA) of Osun State, Southwestern Nigeria, covers about 112 km^2. The area is bounded by Latitudes 7° 28' N and 7° 38' N and Longitudes 4° 28' E and 4° 36' E (Figure 1). Most of the area falls within the region generally referred to as Ile-Ife, which is traditionally divided into five (5) quarters, namely, Ilare, Ilode, Iremo, Moore and Okerewe (Eluyemi, 1978). The two main rivers which drain Ile-Ife town are R. Opa and R. Shasha. Both rivers are tributaries of a larger river, the R. Osun. These rivers are sources of water for domestic and agricultural processes. Natural and anthropogenic activities such as soil erosion and farming carried out within and around Ile-Ife have affected the quality of the surface water found in Ile-Ife City (Aboyeji and Ogunkoya, 2014).

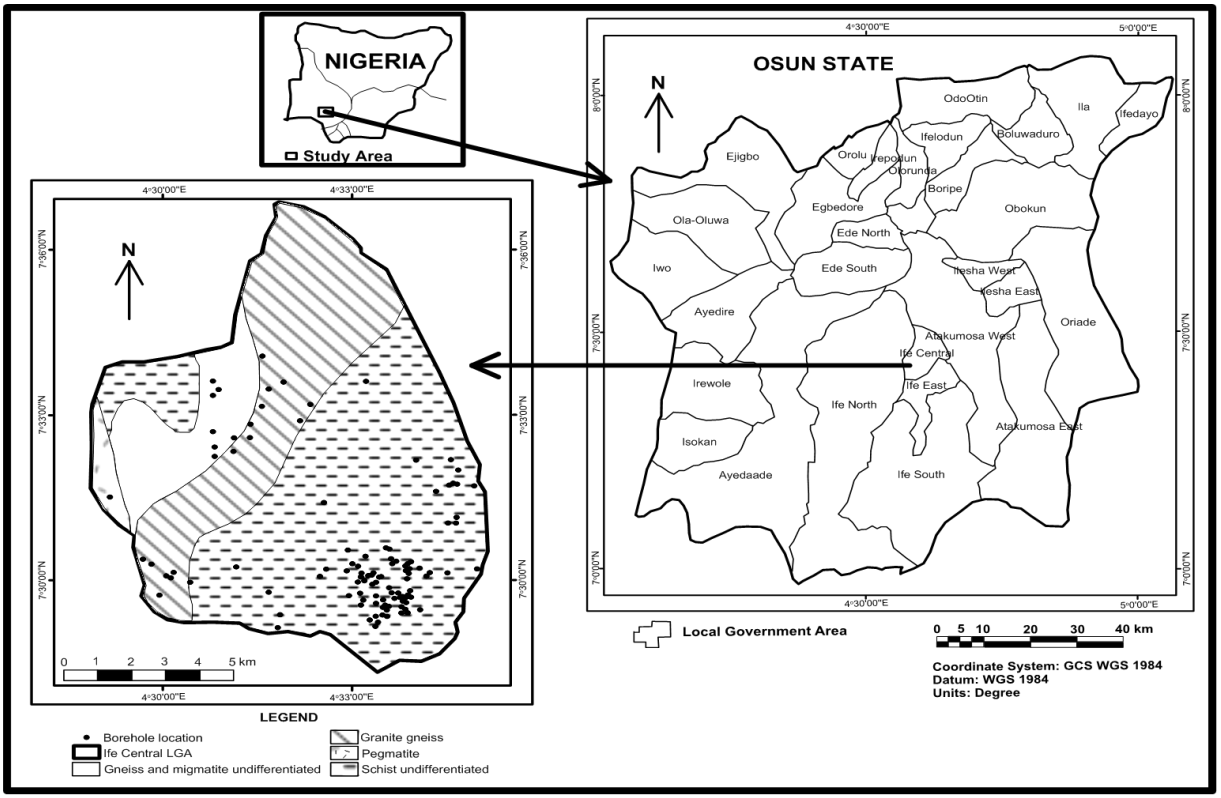


Figure 1: Ife Central Local Government Area (Olorunfemi, 2021)

The Nigerian Constitution confers the responsibility for providing water supply to its citizens on all the three tiers of government: Federal, State and Local. In Osun State, three principal agencies are responsible for providing potable water supply to the public. These agencies are the Federal Ministry of Water Resources and Rural Development (FMWR&RD), Osun State Water Corporation (OSWC) and the Rural Water Supply and Environmental Sanitation Agency (RUWESA) (UN-HABITAT, 2021). The population of Ife Central LGA, according to the 2006 National Population Commission Census, was 167,204. The population has since continued to rise at an estimated growth rate of 2.77% per annum. The projected population of Ife Central LGA in the year 2023 will be 285,714 (UN-HABITAT, 2021). With water use of 120 litres per capita per day, the estimated 285,714 population will require 34,285,680 L/day (34,286 m^3/day) to meet their water needs. The Federal and State Governments have made various attempts to meet the water needs of Osun State, including the study area, Ife Central LGA. For instance, OSWC is responsible for the construction and maintenance of water works, small and mini water schemes in urban and semi-urban areas, including small towns.

Despite the efforts of these governmental agencies, the water needs of the people living within the Ife Central LGA and by extension the Osun State have not been met. NGOs such as the European Union (EU), the United Nations International Children Emergency Fund (UNICEF) and other specialized UN agencies have also made several contributions towards meeting the water needs of the people within the Ife Central LGA. The EU in conjunction with the UNICEF evaluated the performance of State Governments in the Water Supply and Sanitation Sector Reform Program (WSSSRP) carried out between 2005 and 2009. The evaluation was conducted in EU focal states, including Osun State. The report revealed that during the period under review, access to improved water supply in Osun State increased to 78.0% compared to 54.2% at the national level. The area has significant water resources potentials that can be tapped and exploited to provide adequate water supply. These include surface water and groundwater. However, surface water is the most feasible because the area is underlain by the basement complex rocks (Fig. 1) with low groundwater potentials (UN-HABITAT, 2021).

Although the groundwater potential of Osun State has been rated as poor, it is a more reliable source of potable water supply than surface water for several reasons (Akinwumiju et al., 2016; Konwea et al., 2021). Firstly, groundwater is cheaper to develop than surface water. Secondly, groundwater hardly requires pre-treatment or treatment before use. Thirdly, groundwater source is usually available closer to the place of need or usage than surface water. Finally, the technology for extraction, operations and maintenance are more cost effective for groundwater sources than for surface water sources. Even with the low groundwater potential, groundwater sources could serve individual households and communities through the construction of shallow wells and boreholes. The groundwater sources complement the water supply from the Osogbo-Ede surface water-based scheme when it functioned epileptically and are the sole sources of potable water supply since it stopped functioning altogether.

The Osogbo-Ede Water Supply Scheme, located in Ede town, west of Ife Central LGA takes its source from the R. Osun. Potable water from Osogbo-Ede Water Supply Scheme is delivered to Ile-Ife through transmission and distribution mains originating from the Scheme after expensive treatment of the raw water. However, the water supply to Ile-Ife and most parts of Ife Central LGA has been epileptic and irregular. At some point it stopped functioning altogether. There is also the existing Mokuro Water Supply Scheme. This has become a Federal Government intervention project and it is a separate water supply scheme dedicated to some parts of Ile-Ife town. The Mokuro Water Supply Scheme has an installed production capacity of 1,000 m^3/day (Ojo, 2011). However, this scheme is under rehabilitation and is not currently supplying any potable water. Several individuals, private agencies and NGOs have contributed to providing potable water supply through siting of boreholes at strategic locations across Ife Central LGA and Osun State in general. The lack of access to potable water around Ife Central LGA, has resulted in several households,

who have the financial means, to resort to groundwater exploitation privately, through construction of hand-dug wells and boreholes.

Apart from those hand-dug wells and boreholes constructed privately by individuals, government agencies and different levels of government in Nigeria have also provided water supply through shallow wells (some fitted with hand pumps) and boreholes fitted with pumps (motorized boreholes). Although reports revealed that access to improved water supply in Osun State has increased from less than 50% to 78.0% compared to the 54.2% at the national level (UN-HABITAT, 2021); failed groundwater supply facilities are common. Despite the several interventions carried out by governmental, NGOs and private agencies to provide access to potable water, there is still a need for potable water supply within the Ife Central LGA. It is therefore necessary to assess the effectiveness of the groundwater intervention projects carried out within the Ife Central LGA and make recommendations towards improving the potable water supply situation in the study area.

2. Materials and Methods

The hydrogeological method of investigation was employed to assess the groundwater intervention projects within the Ife Central LGA. The investigation entailed borehole auditing, interaction with users of the boreholes, physical assessment of the borehole facility and performance evaluation of the borehole facilities. The specific location of the various groundwater supply facilities was determined and recorded using a Garmin eTrex 10 handheld Global Positioning System (GPS) navigator. Based on the interaction with users of the borehole facilities as well as those who reside around the borehole facilities, information about the borehole facilities such as year of construction, the agencies that sponsored the borehole projects, performance of the borehole and the causes of failure of the failed borehole were acquired.

Residents living close to each borehole were considered as the first set of respondents, unless when later redirected to other people. The borehole facilities were also examined physically to assess the current state of the borehole facility as well as corroborate some of the information obtained from the users of the borehole facilities. The data obtained from the physical assessment of the borehole facilities include borehole location, operational status of the boreholes and type of pumps installed in the boreholes. Based on the data obtained from the interaction with users of the borehole facilities and physical assessment, the performance of the borehole facilities were assessed. One hundred and twenty-nine (129) borehole facilities were audited.

3. Results and Discussion

One hundred and twenty-nine (129) boreholes were audited within the Ife Central LGA. Eighty-seven (87) boreholes were constructed by governmental agencies, twenty-nine (29) boreholes were constructed by NGOs or private agencies, while the remaining thirteen (13) boreholes were constructed by unidentified agencies. Out of the eighty-seven (87) boreholes constructed by governmental agencies, forty-seven (47) boreholes were constructed by the Federal Government, twenty-nine (29) boreholes were constructed by the State Government and eleven (11) boreholes were constructed by the Local Government. Out of the forty-seven (47) boreholes constructed by the Federal Government, twenty-seven (27) boreholes were constructed by the Osun-Ogun River Basin Development Authority (OORBDA), twelve (12) boreholes were constructed as Federal Constituency projects, four (4) boreholes were constructed based on joint intervention by Federal Government and the State Government, sponsored by the European Union (EU) and Water Supply Sanitation Sector Reform Programme (WSSSRP), three (3) boreholes were constructed by the Federal Ministry of Agriculture and Rural Development (FMARD), while one (1) borehole was constructed by the Energy Commission of Nigeria (ECN).

The physical assessment of the boreholes revealed that seventy-one (71) boreholes (representing 55% of the boreholes audited) were functional, while the remaining fifty-eight (58) boreholes (representing 45% of the boreholes audited) were non-functional as at the time of the assessment. Out of the eighty-seven (87) boreholes constructed by the Government, fifty-one (51) boreholes (representing 59% of governmental interventions) were functional, while the remaining thirty-six (36) boreholes (representing 41% of governmental interventions) were non-functional. Out of the forty-seven (47) boreholes constructed by the Federal Government, twenty-five (25) boreholes (representing 53% of Federal Government interventions) were functional, while the remaining twenty-two (22) boreholes (representing 47% of Federal Government interventions) were non-functional. Out of the twenty-nine (29) boreholes constructed by the State Government, eighteen (18) boreholes (representing 62% of State Government interventions) were functional, while the remaining eleven (11) boreholes (representing 38% of State Government interventions) were non-functional.

Out of the eleven (11) boreholes constructed by the Local Government, eight (8) boreholes (representing 73% of the Local Government interventions) were functional, while three (3) boreholes (representing 27% of the Local Government interventions) were non-functional. Out of the twenty-nine (29) boreholes constructed by NGOs or private agencies, nineteen (19) boreholes (representing 66% of NGOs or private agencies intervention) were functional, while ten (10) boreholes (representing 34% of NGOs or private agencies intervention) were non-functional. Out of the one hundred and twenty-nine (129) boreholes, ninety-six (96) were fitted with submersible pumps, while thirty-three (33) were fitted with hand pumps. Out of the 96 boreholes fitted with submersible pumps, fifty-four (54) boreholes (representing 56% of boreholes fitted with submersible pumps) were functional, while forty-two (42) boreholes (representing 44% of boreholes fitted with submersible pumps) were non-functional. Out of the thirty-three (33) boreholes fitted with hand pumps, fifteen (15) boreholes (representing 45% of boreholes fitted with hand pumps) were functional, while eighteen (18) boreholes (representing 55% of boreholes fitted with hand pumps) were non-functional.

3.1 Groundwater Intervention Agencies

The agencies involved in groundwater intervention projects within the Ife Central LGA include the governmental, NGOs or private and unidentified agencies. The governmental agencies include the Local Government, State Government, and the Federal Government agencies. The Federal Government agencies include the Ogun Osun River Basin Development Authority (OORBDA), Federal Ministry of Agriculture and Rural Development (FMARD), Joint Intervention (State and the Federal Government project) between the European Union and Water Supply Sanitation Sector Reform Programme (EU-WSSSRP) and the Energy Commission of Nigeria (ECN). The NGOs or private agencies include the joint intervention between the European Union (EU) and United Nation International Children Emergency Fund (UNICEF) and lastly the unidentified Agencies.

3.2 Assessment of Groundwater Intervention by Governmental Agencies

Out of the twenty-seven (27) boreholes constructed by the OORBDA, fifteen (15) boreholes, representing 56% were functional, while twelve (12) boreholes representing 44% were non-functional. The three (3) boreholes constructed by the FMARD were all functional. Four (4) boreholes were constructed by the Joint Intervention between the EU and WSSSRP. Out of the four (4) boreholes, two (2) representing 50% were functional, while two (2) representing 50% were non-functional. Twelve (12) boreholes were constructed by the Federal Constituency. Four (4) of the boreholes representing 33% were functional, while eight (8) boreholes representing 67% were non-functional. One borehole was constructed by the ECN at Eleyele area. The borehole is functional. Out of the twenty-nine (29) boreholes constructed by the State Government, eighteen (18) boreholes representing 62% were functional, while eleven (11) boreholes representing 38% were non-functional. Out of the eleven (11) boreholes constructed by Local Government, eight (8) boreholes representing 73% were functional, while three (3) boreholes representing 27% were non-functional.

3.3 Assessment of Groundwater Intervention by NGOs

Out of the twenty-nine (29) boreholes constructed by NGOs or private agencies, thirteen (13) boreholes were constructed by the joint intervention between the EU and UNICEF, while sixteen (16) boreholes were constructed by the private agencies. Out of the thirteen (13) boreholes constructed by the joint intervention between the EU and UNICEF, nine (9) boreholes representing 69% were functional, while four (4) boreholes representing 31% were non-functional. Out of the sixteen (16) boreholes constructed by non-governmental or private agencies, ten (10) boreholes representing 63% were functional, while six (6) boreholes representing 37% were non-functional. Out of the thirteen (13) boreholes constructed by unidentified agencies, one (1) borehole representing 8% was functional, while twelve (12) boreholes representing 92% were non-functional.

3.4 Performance Assessment of Various Agencies

Analysis of the data obtained from the assessment of the borehole intervention projects in Ife Central LGA has shown that governmental, NGOs or private agencies and unidentified agencies provided support to

the groundwater intervention projects in that order. The percentage contributions of these agencies are 67%, 23% and 10%, respectively. Despite the level of support provided by the various agencies to reduce water supply problems through the construction of boreholes, some of the borehole facilities are not functional. This set of boreholes failed due to various reasons, therefore does not meet the intended purpose.

3.5 Causes of Failure of the Groundwater Intervention Projects

Apart from three uncompleted boreholes, other causes of failure of these groundwater intervention projects as observed from the field investigation include but are not limited to the following:

1. Pump failure;
2. Maintenance; and
3. Stolen pump.

3.5.1 Pump Failure

Pump failure is the most dominant cause of failure in boreholes of the groundwater intervention projects embarked upon in Ife Central LGA. Pump failure occurs when the pump breaks down as a result of pumping silt, clay and sand with the groundwater due to improper casing and or screen design in the construction of the borehole. The intake of these materials along with groundwater cause wear and tear of the pump, resulting in the ultimate failure of the groundwater supply facility. Out of the fifty-eight (58) failed boreholes within the Ife Central LGA, twenty-one (21) boreholes (representing 36% of the failed boreholes) failed as a result of pump failure. Out of the twenty-one (21) boreholes that failed due to pump failure, sixteen (16) boreholes (representing 76% of failed boreholes attributed to pump failure) were from the governmental agencies, while the remaining five (5) boreholes (representing 24% of the failed boreholes attributed to pump failure) were from the NGOs or private agencies. Out of the sixteen (16) failed boreholes constructed by governmental agencies, thirteen (13) failed boreholes were constructed by the Federal Government agency, while the remaining three (3) failed boreholes were constructed by the State Government agency. None of the boreholes constructed by the Local Government failed as a result of pump failure.

3.5.2 Lack of Maintenance

Lack of maintenance of boreholes results in the failure of boreholes. Borehole failures resulting from the lack of maintenance were observed within Ife Central LGA. Borehole maintenance is essential to maximizing the long-term life of water supply facility. The maintenance of groundwater supply facility involves the continuous monitoring of the water supply facility. This entails regular visit, monitoring and servicing or changing of worn-out parts of the groundwater supply facility. Routine monitoring of boreholes helps to prevent deterioration of groundwater supply facility. Lack of maintenance results in failures of groundwater supply facilities. Nine (9) boreholes (representing 16% of the failed boreholes) failed as a result of lack of maintenance culture. Out of the nine (9) failed boreholes, seven (7) boreholes (representing 78% of failed boreholes attributed to lack of maintenance culture) were constructed by the Federal Government agency, while the remaining two (2) failed boreholes (representing 22% of the failed boreholes attributed to lack of maintenance culture) were constructed by the State Government agency.

3.5.3 Stolen Pump

Borehole failure resulting from the stealing of pump was observed in this study. The absence of pump in a borehole renders the borehole incapable of yielding groundwater. Any borehole that does not deliver groundwater is said to have failed. Four (4) boreholes (representing 7% of the failed boreholes) failed within Ife Central LGA due to stolen pumps. All the four (4) failed boreholes were constructed by governmental agencies. Three (3) of the boreholes representing 75% were constructed by a Federal Government agency while the remaining one (1) failed borehole was constructed by State Government agency.

3.5.4 Borehole Failure due to Unknown Causes

The cause of failure of some boreholes from the groundwater intervention projects within the Ife Central LGA could not be ascertained by physical assessment of the facility and enquiry from users of the facility. Some causes of borehole failure are not easily detectable from physical assessment of the facility. Furthermore, most residents reported that the groundwater supply facility broke down before they moved into the community. Some of the likely causes of failure of this set of boreholes include borehole tapping groundwater from aquiclude and poor siting of the borehole. There were twenty-four (24) boreholes (representing 41% of the failed boreholes) whose cause of failure could not be ascertained.

4. Discussion of Results

Apart from the boreholes located in Ilare community which were completed in 2001, the other boreholes were completed between 2005 and 2020. The eighty-seven (87) groundwater intervention projects carried out by governmental agencies are numerically more than the twenty-nine (29) groundwater intervention projects carried out by the NGOs or private agencies, implying that the governmental agencies are the major actor in supplying the water needs of the people. The Federal Government provided 54% of the groundwater intervention projects, followed by the State Government with 33%. Among all the Governmental agencies, the Local Government contributed the least with 13% to the groundwater intervention projects.. The varied degrees of contribution to the groundwater intervention could be attributed to the large discrepancy in the Federal, State and Local Government annual financial allocations.

From the 2020 fiscal year, the Federal Government allocation for water sector was 91 billion naira, while the Osun State Government allocation for water sector for same year was 7.6 billion naira (BudgiT, 2020; Ministry of Economic Planning and budget, 2020). The Ife Central LGA budget allocation for the year 2020 was not available. However, it is expected that the Local Government financial allocation would be far less than the Federal and State allocations for water sector since the Local Government is a sub-unit of the State Government. This same reason accounts for the low number of groundwater intervention projects carried out by the Local Government relative to those carried out by the State and Federal Governments. It could therefore be inferred that the low contribution of the Local government in the groundwater intervention projects relative to other tiers of government is due to the lesser amount of money at their disposal.

The results of the investigation also revealed that the groundwater intervention projects embarked upon by the Local Government agency had the highest success rate of 73% followed by the State Government with a success rate of 62% and lastly the Federal Government with a success rate of 53%. Hence, the failure rates of the groundwater intervention projects were 27%, 38% and 47% for the Local, State and Federal Governments, respectively. Though the Local Government had the least contribution to the groundwater intervention projects, interaction with the Head of Works Unit of the Ife Central LGA revealed that their closeness to the community, training of the local population and provision of spare parts for the groundwater supply facilities helped in the proper monitoring, supervision, and maintenance of the projects.

5. Conclusion

This study evaluated the effectiveness of public and private interventions in providing water supply for residents of Ife Central LGA of Osun State through construction of boreholes and hand-dug wells. The public groundwater supply facilities are groundwater intervention projects carried out for the purpose of supplying potable water to the people. One hundred and twenty-nine (129) boreholes were audited in this study. The boreholes were constructed by governmental and NGOs or private agencies. Eighty-seven (87) boreholes were constructed by governmental agencies, twenty-nine (29) boreholes were constructed by NGOs, while thirteen (13) boreholes were constructed by unidentified agencies. The groundwater intervention projects were not very effective as only seventy-one (71) boreholes representing 55% of the 129 audited boreholes were functional, while the remaining fifty-eight (58) boreholes representing 45% were non-functional. The ineffectiveness of the intervention projects could be attributed to the lack of interaction of the sponsoring agencies to the beneficiary communities, lack of borehole maintenance by both the agencies and the beneficiaries and lack of spare parts for the groundwater supply facilities.

Recommendations

Based on the results of this study, the following actions are recommended:

1. There is need to develop and coordinate water sector policies at the Federal, State and Local Government levels as well as the private agencies for more effective groundwater intervention projects;
2. The Federal Government agencies may wish to consider handing over completed projects to the State, Local Agencies or the Beneficiary Communities to encourage local participation and ownership of the intervention projects;

3. The Local government or their agencies should be responsible for training local personnel in the beneficiary communities in operations and monitoring of the facility for sustainability of the projects;

4. Materials used in the completion of groundwater supply facilities should be such that the spare parts are readily available and affordable for the beneficial community, alternatively, there should be stock of spare parts at the delivery of the projects, especially pumps and fittings;

5. Rehabilitation of the failed boreholes should be considered before making decisions to construct new ones. This is cheaper and faster to achieve, especially with failed boreholes with minimal problems, such as stolen pumps;

6. Data collection and monitoring of the groundwater intervention projects by the agencies are required for the assessment and expansion of the groundwater intervention project;

7. Groundwater intervention projects should include regular water quality assessment to ascertain and monitor the groundwater quality; and

8. Adequate security should be provided at the groundwater supply facilities to prevent vandalization and theft of components of the borehole facilities.

REFERENCES

Aboyeji, O.S., Ogunkoya, O.O., 2014. Wetland sustainability and urban growth in southwestern Nigeria: an example from Ile-Ife. Nigerian Field Society, 79 (1/2), Pp. 3–24. http://www.nigerianfield.org/

Agunwamba, J.C., Nwoji, C.U., Ezeokonko, J.C., Solomon, P.B., 2010. Comparison of Performance of Public and Private Boreholes. Nigerian Journal of Technology, 29 (3), Pp. 42 – 47.

Akinwumiju, A.S., Olorunfemi, M.O., Afolabi, O., 2016. GIS-Based Integrated Groundwater Potential Assessment of Osun Drainage Basin, Southwestern Nigeria. Ife Journal of Science, 18 (1), Pp. 147 – 168.

BudgiT, 2020. 2020 approved budget analysis. YourBudgiT. (Accessed 25th May 2021) Available on: https://www.google.com/url?sa=t&source=web&rct=j&url=https://yourbudgit.com/wp-content/uploads/2020/01/2020-Approved-Budget-Analysis.pdf

Chima, G.N., 2000. Analysis of Water Supply Shortages and their Causes in Parts of Imo State. Nigeria. Abia State University Environmental Review (ASUER): A Journal on the Environment, 1 (I), Pp. 68 – 78.

Eluyemi, O., 1978. The Living Art and Craft of Ile-Ife. Ile-Ife: Adesanmi Printing Works. Pp. 47.

Konwea, C.I., Ajayi, J.O., Bakare, T.A., 2020. Performance of Boreholes and Hand-Dug Wells in the Crystalline Rocks of Osun State, Southwestern Nigeria. International Journal of Scientific & Technology Research, 9 (01), Pp. 3408–3418. http://www.ijstr.org/final-print/jan2020/Performance-Of-Boreholes-And-Hand-dug-Wells-In-The-Crystalline-Rocks-Of-Osun-State-Southwestern-Nigeria-.pdf.

Konwea, C.I., Ajayi, O., Salami, B.M., 2021. Integrated Geophysical and Hydrogeological Assessment of the Groundwater Resources of Obafemi Awolowo University Campus, Southwestern Nigeria. In: Proceedings of the 56th Annual International Conference and Exhibitions of the Nigerian Mining and Geosciences Society (NMGS). Pp. 111 - 116.

Ministry of Economic Planning and Budget (Budget of Restoration), 2020. 2020 Citizen Budget. (Accessed 27th May 2021). Available on: https://osun.gov.ng/%3Fdl_id%3D141&ved=2ahUKEwif59ze09rwAhXJilwKHXEQDHYQFjAAegQIAxAC&usg=AOvVaw2HCjn_H7bFPj22cWYr3VIB

Ojo, O., 2011. A Study of the Rural Water Supply-demand Situation in Southwest Nigeria. WIT Transactions on Ecology and the Environment, 145, Pp. 51–61. DOI:10.2495/WRM110051

Olorunfemi, H.K., 2021. Performance Evaluation of Borehole Intervention Projects in Ife Central LGA, Osun State, Nigeria. Unpublished B. Sc. Thesis, Department of Geology, Obafemi Awolowo University, Ile-Ife, Nigeria, Pp. 88.

Olorunniwo, I., Oke, I.A., Aboyeji, O.S., Soumah, M., Olorunfemi, A.O., 2014. Spatial Distribution of Groundwater Utilization in Obafemi Awolowo University, Ile-Ife, Nigeria. International Journal of Ecology and Environmental Studies, 2 (1), Pp. 48 – 53.

UN-HABITAT, 2014. Structure Plans for Ile - Ife and Environs State of Osun Structure Plans Project UN-Habitat. (Accessed 10th April 2021). Available on: https://unhabitat.org/structure-plans-for-ile-ife-and-environs-state-of-osun-structure-plans-project.

WHO and UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2006. Meeting the MDG Drinking Water and Sanitation Target: the rural and urban challenge of the decade. World Health Organization. (Accessed 15th May 2021). Available on: https://apps.who.int/iris/hndle/100665/43488

World Health Organization, 2018. Mortality and Burden of Disease from Water and Sanitation. (Accessed 15th May 2021). Available on: https://www.who.int/gho/phe/water_sanitation/burden_text/en/#:%7E:text=In%20the%20year%202016%2C%20water,environmental%20contributor%20to%20ill%20health.

World Health Organization and United Nations International Children Fund (UNICEF), 2015. Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment. World Health Organization. (Accessed 20th May 2021). Available on: https://apps.who.int/iris/handle/100665/177752..