

Sustainability of Public Sector Water Projects: A Case of Anambra-Imo River Basin Development Authority, Nigeria ¹

ⁱUche Godswill Onyeka, ⁱⁱIbeawuchi Ifeanyi Echeme, PhD,

ⁱⁱⁱEmmanuel Chinenye Ubani, PhD

ⁱMD/CEO, Transparent Projects Services Ltd, Owerri, Imo State, Nigeria

^{ii, iii} Project Management Technology, Federal University of Technology, Owerri, Imo State, Nigeria

Abstract

This study appraised public sector water project performance for sustainability. The objectives are: to appraise the influence of community ownership, involvement and participation on sustainability of public sector water projects in Anambra-Imo River Basin Development Authority (AIRBDA); to examine the extent to which water level of the areas affect the sustainability of public sector water project in AIRBDA; to determine the influence of technology used in extraction of water to the sustainability of public sector water project in AIRBDA and; to ascertain the level of influence that the distance between the beneficiary and location of water projects have on the sustainability of the projects in AIRBDA. Descriptive survey method was adopted and data collected via questionnaire. Data collected were analyzed using descriptive statistics and t-test technique. The results show that Community ownership & Involvement, water level and, technology use in the extraction of water have significant influence on public sector water project performance, while distance between the beneficiaries and water project location does not significantly influence on the performance of public sector water projects. Hence, the study recommends; Proper orientation/user education & needs assessment of public water projects, detailed investigation on the hydrogeology and ground water level, cost effective and easy to maintain type of technology for public water projects and, removal of bureaucratic tendencies in sitting public sector water projects and the survey carry out to determine the most suitable location to site the project to reduce the suffering of the people and enhance sustainability.

Keywords: Sustainability, public sector, project performance, Anambra-Imo River Basin Authority, community ownership & involvement, ground water level.

1.0 INTRODUCTION

Water is a natural resource that is necessary for sustenance of life, ecological system and a key resource to social and economic development. Government, non-governmental organizations,

¹ How to cite this paper: Onyeka, U. G., Echeme, I. I., Ubani, E. C. (2026). Sustainability of Public Sector Water Projects: A Case of Anambra-Imo River Basin Development Authority, Nigeria; *PM World Journal*, Vol. XV, Issue V, May.

local and international organizations from all over the world have implemented water projects to promote safer rural water supply and sanitation over the years. However, in most project areas, there is lack of sustainability of these water infrastructures and water supply systems as a result of economic, social and environmental factors. (Harvey & Reed, 2007) attributed it to lack of community ownership of the projects.

Recent figures of operational failures rate from different African countries range from 30 – 60% (Sutton, 2025) Anambra-Imo River Basin Development Authority (AIRBDA) is no exception. AIRBDA is a parastatal under the Ministry of Water Resources, a ministry with the direct responsibility for water provision to the general public across the nation. Like other river basin development authorities in Nigeria, AIRBDA is in charge of catering for water and agricultural need of people in the five South-eastern (Abia, Anambra, Ebonyi, Enugu, and Imo) States (Onyeka, 2024).

However, it is a common phenomenon to observe non-functional water systems just a few years after implementation e.g. lack of adequate protection such as fencing the project site, vandalization of solar pumping systems for boreholes, non-operational and complete abandonment of other water projects in various communities in the Southeast where the AIRBDA control.

Studies have revealed that the main issue in these communities is willingness and the ability of these communities to manage and maintain these water projects and its accompany infrastructures through commitment of time and resources to the protection, operation and maintenance of rural water influence the sustainability of water projects (Gleitsmann, 2005). According to Harvey and Reed (2007) community involvement strongly influence sustainability of water infrastructures. AIRBDA has done remarkably well in the area of providing water and accompany infrastructures across the states under their operational area. There is presence of AIRBDA water project in virtually all the communities in the south east. Huge amount of resources has been deployed through the authority to cater for the water needs of the communities. However, constituent projects from the government are carried out through the authority and most of the politicians representing various constituencies have in the past and present received a fair share of water projects from the authority.

Unfortunately, casual observation reveal that most of these projects are not serving these communities. Nevertheless, the projects are completed and handed over to the people, but benefits are not there. Out of the 15 project surveyed, only 5 is functional as at the time of this study (see Appendix). This represent 33.33% sustainability. This is low. One keeps wondering if the ‘need assessment’ of these projects were not carried out before embarking on these water projects (Onyeka, 2024). The non – operational water resource projects in the operational area of AIRDBA leaves a lot to desire. It is against this background that this study seeks to investigate the factors influencing sustainability of these water projects and to find ways to increase sustainability in the water project to make them meet their objectives.

Nigeria as a signatory to the United Nations declaration of the right to water has a duty to provide access to portable water for every household. To achieve this, the Federal Government of Nigeria undertook an institutional arrangement where the three tiers of government share the statutory responsibility for the provision of portable water to every household. The federal government,

through the ministry of water resources, created in 1976 the River Basin Development Authority (RBDA) to cater for their own part of the responsibilities. UNICEF (2018) survey shows that though Nigeria is making progress in improving access to water, sanitation and hygiene (NASH) to its citizen, the amount and quality of water for individual use is lower than the required standard.

However, the Federal Ministry of Water Resources through the RBDA appear to have failed in achieving the mandate, since the existing water projects are not meeting the objective and are not sustainable to serve the future generation (Onyeka, 2024). Low performance and lack of sustainability of these projects has resulted to more spending of funds for the same purpose. In a depressed economy like Nigeria, these funds could be used for alternative projects that will positively affect the people. One of the consequences of low performance and lack of sustainability of the projects is its direct impact on the health of the people. UNICEF (2018) study showed lack of access to portable water as a major cause of high morbidity rate among children. The study according to UNICEF (2018) indicates that extraordinary effort is needed by Nigeria to achieve the mandate of water for all by 2030. The study also revealed that Nigeria will required about 1.7% of its Gross Domestic product for the provision of water facilities to Nigerians. Most researches are based on how to increase funding and extend projects to more communities (Echeme, Okwara & Okangba, 2022). Without the existing water projects functioning at their optimal capacities and are sustained, this goal will be difficult to achieve. Hence, this study tends to identify the causes of low performance and lack of sustainability of these existing water projects through AIRBDA.

The specific objectives include;

- i.) To assess the influence of community ownership, involvement and participation on sustainability of public sector water projects in Anambra Imo River Basin Development Authority.
- ii.) To examine the extent to which water level of the areas affect the sustainability of public sector water project in AIRBDA.
- iii.) To determine the influence of technology used in extraction of water to the sustainability of public sector water project in AIRBDA.
- iv.) To ascertain the level of influence that the distance between the beneficiary and location of water projects have on the sustainability of the projects in AIRBDA.

The following hypotheses were formulated to assist in achieving the objectives;

H₀₁: Community ownership, participation and involvement do not influence the sustainability of public water projects in Anambra Imo River Basin Development Authority.

H₀₂: Water level of an area cannot affect public sector water project sustainability in Anambra Imo River Basin Development Authority

H₀₃: The technology used in extraction of water have no significant influence on the sustainability of public sector water projects in Anambra Imo River Basin Development Authority

H₀₄: The distance between the user and the water project location have no significant influence on public sector water project sustainability in Anambra Imo River Basin Development Authority.

Nigeria as a signatory to the United Nations Declaration of right to water have obligation to make water available to every household. AIRBDA is among the agencies which the government intends to achieve this objective. The depressed nature of Nigeria economy can no longer sustain further wastages of tax payer's money on water projects when past and existing ones are not performing well and no genuine sustainability pathway.

The study intends to:

Assess public sector water project performance through AIRBDA to identify critical factors that could influence performance and sustainability of this project. This will help them reduce cost of executing project in communities that already benefited and avail them the opportunity of extending projects to communities that have not benefitted thereby closing the gap on people without access to portable water.

The study will be beneficial to the community members to understand that projects in their communities belong to them. Success and failure of these projects will have direct effect on them. This will help them to guide and protect these projects to the best of their abilities.

The study's recommendations are critical to AIRBDA and other donor agencies implementing water projects at communities, since these stakeholders will learn from the practices and pitfalls in the projects under study. Moreover, they will gain from the study because they will understand the need to prioritize and mainstream community participation and choice of technology in all phases of projects which is the bedrock of sustainability of every public sector water projects.

Literature Review

This study was carried out with the broad objective of assessing public sector water project performance for sustainability with Anambra Imo River Basin development Authority as case study. However, this study argue that over three decades of the establishment of AIRBDA, there appears to be a disparity between its objective and what has really been achieved. Most of these objectives are short termed with little or no sustainability due to a variety of factors.

Notable amongst these factors include lack of community ownership and involvement in water projects, lack of adequate investigation into the hydrogeology and water resource nature of the communities where water projects are sited, lack of simplicity of technology used in extracting water and, distance from the water project location and the beneficiaries (Onyeka, 2024). Interestingly, access to potable water has become one of the fundamental human rights (UNICEF 2013). The world all over have come to terms with this reality. Government and so many local and international donor agencies have over time made very huge donations and supports to the public sector in the areas of access to portable water (Echeme, et al. 2022).

Public sector being organization owned and managed by government to provide services for its citizen without intention to seek or make profit. To carry out these functions, the government

cannot share money from house to house but must operate through agencies and parastatals which AIRBDA is one of them. There is virtually no community within the operational base of AIRBDA without a water project. But it is disheartening to see that a large number of the projects are abandoned or not functioning .

Public Sector Water Project

Public project is an ambiguous one, but in very broad terms, it refers to a project that is financed by a government and is typically owned, and may be operated by the government. The performance of such projects must be within the context of the policy objectives. It must focus on the outcomes and outputs not merely inputs (Onyeka, 2024).

One of the key issues in project management is on what needs to be done to improve project performance (Love, et al, 2011). Several researchers have noted that there is no consensus on project performance criteria that can be used across various projects. (Zhang & Fan, 2013; Khan, et al 2014). This probably could be as a result of the fact that people see project performance from different perspectives. For instance, a project may seem successful to a client but unsuccessful for a contractor or end users (Jugder & Muller, 2005). A review of extant literatures reveal a number of project performance evaluation models are in use with one of the most commonly used models being the “Iron Triangle” or “Golden Triangle” in which project performance is evaluated on the basis of completion of the project, within time, cost and quality (Onyeka, 2024).

However, various researchers (Yu, et al, 2005) have challenged the use of iron triangle criteria due to its simplicity in evaluating project performance and have proposed inclusion of other aspect such as key stakeholder’s satisfaction, future potential to the organization and customer’s benefits. In exposing the weakness of the “Iron Triangle”. Hwang, et al. (2013) suggests that project performance can be assessed in both qualitative and quantitative terms by considering outcomes such as cost, time, safety, quality and rework. Further to that Zhang and Fan (2013) developed a model for evaluation of the projects performance in the construction with model parameters being meeting project’s overall performance (time, cost and quality); meeting owner’s requirement, meeting project’s multiple goals (health and safety, risk management, claims management) and absence of conflict and stakeholders’ satisfaction. However, Gowan and Mathew (2005) contend that project performance can be assessed through time, cost, quality, satisfaction and business value parameters.

Public sector water projects are the same with other projects in the sense that they share the same characteristics. In a functional public sector organization, projects including water projects do not emerge without needs assessment and strategic planning with set aims and objectives. The extent to which these water projects meet the needs of the people determines how well these projects have performed. The performance measurement system of these projects should be based on the objectives set by strategic plans and it should measure the achievements. Kennerly, (2002) noted that performance measurement as public sector is not quite easy. Current systems for measuring performance in public sector present some limitations due to the fact that it tends to measure efficiency, effectiveness and economic indicators, which are mainly financial and fails to measure the fulfillment and social objectives of the public sector organization. However, public sector water projects are initiated and executed with the broad intention to create access to portable water

to households. When public sector water projects do not meet the needs of the people with respect to the aims and objectives, it will be termed a failed project or abandoned project (Onyeka, 2024).

Community Ownership, Involvement and Participation

For any water project or any other project to succeed and become sustained, there must be full ownership by the community in which the project is sited. Social interaction is part of human life. It begins with the interaction through the years of dependency during which the child is taught the shared value and practices of elders and peers and unknowingly makes commitments in places. This continues as he becomes an adult. Thus it makes sense to consider community by looking at the relationship that exist between interaction and commitment to a given group and place. Human beings are interdependent of one another. Out of being interdependent and various activities involved, it creates interaction which in turn results to sentiment of the individuals to a given interdependent group. Therefore the strength of a group to unite and direct its members action will depend on the degree of interdependence and sentiment generated between members and group as a whole (Minar & Greer, 2007). According to Onyeka (2024) communities can be defined by the characteristics of its people's geographic boundaries, history, shared interest, values and power relations, common values, a sense of membership, common needs and commitment to meet them and share history. A community is a multidimensional system which is variable, shaped and re-shaped continuously by changing actions and relationship. Harvey and Reed (2007) define community in terms of area coverage that can be adequately shared by a particular water facility. This definition applies to studies related to rural water supply.

The term "sense of ownership is frequently deemed as a significant characteristic of community development work (Echeme et al. 2022). A sense of ownership is described as a concept through which to assess whose voice and opinion is heard, who influences a decision, who is affected by project implementation process and outcome (Onyeka, 2024). Applying the concept of ownership makes it easier in determining how the interest and actions of individuals or organization contribute to community development work. Individuals are engaged authentically and intimately, the level of dedication to the process and outcome will be enhanced. This will lead to great chances of support in implementation and realization of community development goals (La Chapelle, 2008)

Community management has become the main model in management of rural water supplies over the past two decades despite its popularity among donors and implementing agencies (Onyeka, 2024). Low level of sustainability are common in most water supply system in Pakistan, Peru, Bolivia and India. Community participation is a prerequisite for sustainability while community management is not for community management system to be sustainable, they require technical assistance, training, monitoring, motivation and encouragement (Harvey & Reed, 2007)

According to Fielmma (2011), in a study conducted in Ghana, community ownership does not mean that community will not receive support from external sources. Support may be received from government or other agencies in the form of subsidies and technical support, but the community itself should own the system, make decisions on when to seek support, and exercise control over access to the system. Community ownership and management empowers communities through genuine partnership to advocate for water services. Communities are able to actively participate in the whole process of acquisition and operation of the facilities. This implies that communities have

to elect water management committee that will be responsible for the management of water facilities (Onyeka, 2024). The communities are responsible for all operations and maintenance, cost of the facilities. This implies that the sustainability of the facilities rest on the community. A water facility bank account is required where funds raised for new investment, operation and maintenance are kept.

In Nigeria, rural water projects have suffered as a result of poor co-ordination, poor maintenance culture and lack of community ownership, poor technical and institutional structure and over bearing bureaucratic control by various supervisory ministers (Echeme, 2017). Due to lack of community participation this has led to poor operation and maintenance of water projects. This is because of use of inappropriate technology, incorrect location of supply systems (Onyeka, 2024). Water being sold expensively and lack of social acceptability because of presence of minerals which affects water taste for a few water sources. The demand for community water supply project are localized demand, hence managerial decision about level of service location of water facilities and cost sharing should be made locally. Community roles are not limited to finance and maintenance. Communities must be involved from the start, in decision about which system they want, what price to pay for water and where to locate water projects. Such involvement enhances community ownership of water projects (Onyeka, 2024). Key feature of community ownership and management include the community having legal ownership and control of services, selecting the site of water points, selecting the level of services it requires, can afford and sustain with human and financial means, the community has to set up a committee that is accountable for management of water projects, accept complete responsibility for operation and maintenance of water system including collection of funds and purchasing of goods and services required in maintaining the system (Echeme, 2017). Also, the community should appoint its own caretakers to receive training and tools and be responsible for corrective maintenance and repairs. The community should be ready to clean, fence and maintain the areas around the water projects (Nwankwoala, 2011).

Project sustainability is most often defined as meeting the needs of the present without compromising the ability of the future generations to meet theirs (Echeme, et al., 2022). It has three main pillars: economic, environmental and social. Project sustainability involves both individual and organizational responsibility to ensure that outputs, outcomes and benefits are sustainable over life cycles and during their creation, disposal and decommissioning. Morfaw, (2014) noted that most projects are failing because of lack of an appropriate sustainability plan. Generally, for projects to be sustainable, certain metrics and standards need to be set from project identification through feasibility studies, formulation, design, appraisal, funding, implementation, monitoring and evaluation.

Empirical Review

It is known fact that there are various text available by renowned authorities concerning public sector water projects. These materials before and in recent time had either addressed availability of public sector water project infrastructure or cost implication of these projects to the economy. Little or no attention had been paid to assess these projects performance for sustainability.

One of the relevant studies were made by Echeme, et al., (2022) on the work on Models for the Sustainability of World Bank-Assisted Development Projects in Nigeria. The objectives of the

study are to determine the key elements that constrain the sustainability of World Bank-assisted development projects in Nigeria; ascertain the variables that contribute to the sustainability of World Bank-assisted development projects in Nigeria. Descriptive Survey design was used. Primary data were collected via the Questionnaire and analyzed using the Multiple Discriminant Analysis and Analysis of Variance. The results show that: funding is the only element that can constrain the sustainability of World Bank-assisted projects; Users training, research consideration in policy making, funding, ownership, project monitoring, sustainability costs, insincerity and insecurity level contribute to the sustainability of World Bank assisted development projects in Nigeria. Among others, the study concludes that sufficient and steady funding are critical; and strict implementation of Community Driven Development approach as contained in the World Bank Project Implementation Policy and Programmes. However, the study generated Fisher's Discriminant models to serve as the Project Sustainability Profile (PSP) for the sustainability management of the World Bank-assisted projects in Nigeria and the conceptual framework was modified based on the findings made in this study. But the study did not consider water projects.

Dosumu and Agbarboa, (2017) noted that poor planning from the side of government and also contractors such as poor contractor estimations been linked to failures in projects in Nigeria.

Nweze (2016) identified socio-cultural and political interferences as a major factor in project failures without exemption to water project. He noted lack of continuity in projects established which has seen succeeding government fail to allocate funds for completion of projects started by their predecessors. Nweze (2016) cited reasons such as migration of skilled professional to other countries as part of the contributory factors to the issues of incompetence in Nigeria projects.

Ijewereme (2015) stated that corruption in the public sector has hindered the performance of projects. Though attempts have been made to stop these practices, the problem still lingers and contributes to the menace of project failure in Nigeria.

Okuntale, (2015) stated that in Nigeria today, despite the high population, most projects including water projects suffer from inadequate skilled professionals to execute the project.

Zuyofa (2014) noted that water projects like other projects can experience delay or abandonment caused by financial issues. The studies show that client's financial difficulty is one of the major causes of delays and abandonment of water projects.

Pinto (2013) suggested that in an event that clear outlines of deliverables in a project are not stated while planning, the project might fail. This simply means that water projects which commence without a proper plan and knowledge of the constraints involved is at risk of failing.

Sonuga et al., (2012) identified poor leadership and corruption in the design, contracting, estimation and implementation of projects. These have seen projects skyrocket in costs, rack up time overrun became too costly for government and its agencies have led to abandonment, low performance and failure.

Ochella (2012) concluded that community participation during conception, designing, implementation, operation and maintenance of water project influences sustainability of water projects. The study also noted that the technology used influences sustainability of public water projects.

Studies by Pourrastam and Ismail, (2011) in Iran show that, poor planning is a root cause of many project failures including water projects. Similarly, this same problem was found to be true in Nigeria construction projects (Okwanelu, 2010).

Nwankwoala, (2011) found out that for effective performance of public sector water projects, the project executed in the communities must be owned and managed by the community after project delivery. The study by Nwankwoala, (2011) shows that upon the availability of ground water, Nigeria is faced with increasing demand for water resources due to high population growth rate and growing prosperity.

Olarufemi (2011) carried out study on effect of sustainable technology policy option for rural water supply managed in selected rural areas of Oyo state, Nigeria. It was found out that after several years of water supply developed in Nigeria, it is unfortunate that as many as 43 percent of population still lacks water. The study revealed that knowledge base of different stakeholder about technology, socio-economic and ecological dimension of water resources management is very low and need to be improved.

Studies by Cobbins and Davie (2010) show that the earth has larger volume of ground water compared to all the fresh water in rivers and lakes up to one hundred times greater.

Melvor (2008) studied various water programmes implemented in the Zambezi valley, Zimbabwe. The study showed that the project failed due to the facts that the local communities did not regard the water facilities as their own.

Harvey and Reed (2007) define community in terms of area coverage that can be adequately shared by a particular water facility. Study by them in Pakistan, Peru, Bolivia and India shows low level of sustainability and proves that Community participation is a prerequisite for sustainability.

Kayagu, et al, (2006) shows that over the years, in most developing nations, the situational analysis of the water provided by most of the government owned water utilities have been characterized by poor water quality, incessant intermittent flow to non availability, the step to evaluate the performance of these utilities has been well spelt out by some international organization such as American water world association.

Okeola (2005) enumerated many approaches covering a wide range of issues in search of sustainable water supply provision in the last three decades by government. The result shows that a larger percentage of the populace still do not enjoy portable water supply in the country. This is partly, due to the poor performance level of water supply projects in the country.

Buffon, (2005) noted that the failure rate of government water projects in different countries agencies ranges between 30% - 60%. This point directly to the fact that in most cases, operational procedures takes precedence over project management procedures and guidelines.

Mackenzie and Isah, (2005) conducted a study in rural India. It revealed that apporximated a third of india’s hand pumps on rural water projects are either non functctional or in need of repairs. This is as a result of technology by that is not friendly to the people.

Methodology

This study employed a descriptive survey research design. This is because descriptive survey design focuses attention on the formulation objectives, design of data collection instrument, collection of data, processing and analyzing data and reporting finding (Nworuh, 2017) a descriptive survey involves administering questionnaires to individuals by mail, telephone or in person. This research design method was used because the method has the potential to provide a lot of information from quite a large sample of participants. By employing this study design, quantitative data were collected from a cross section of community members and qualitative data was obtained from the staff of AIRBDA.

However, this study was conducted in some communities under the operations of AIRBDA. Water projects in these communities serve a population of 9,920 people. It is from this population that a representative sample was drawn and administered questionnaire. Water committee member from the 15 communities were involved in the focus group discuss because they were in a position to provide vital information. The questionnaire was administered only to the respondents who have direct knowledge of the projects under study.

Table 1 List of Communities Studied and Their Respective Population

S/ N	State	Location	Technology Used	Population	
				2006	2021
1	Imo	Omene square , Isiogwu village, Ideato South LGA	Solar powered	304	487
2	Imo	Amigbo Nguru, Ngor Okpala LGA	Solar powered	325	521
3.	Imo	Umukabia Okwuato, Aboh Mbaise LGA	Electric powered	242	387
4	Abia	Umuigbede Obinulo, Ngodo Isiochi LGA	Electric powered	501	804
5	Abia	Market Square old Umuahia, Umuahia North LGA	Solar powered	207	331
6	Abia	Nkwokoro Umuoleke, Isiala Ngwa South LGA	Electric powered	613	981
7	Anambra	Emenike Compound Okuzu, Oyi LGA	Electric powered	515	826
8	Anambra	Ogbefere Market Okpoko, Ogbaru LGA	Solar Powered	613	981
9	Anambra	St. Augustine Anglican Church Ubiama, Olumba North LGA	Electric powered	486	778
10	Enugu	Central School Ugbene –Ajima, Uziouwani LGA	Electric powered	410	667
11	Enugu	Aluka town, Nsukka LGA	Electric powered	406	649
12	Enugu	Aguibechi Autonomous Community, Igboeze North LGA	Electric Power	265	424
13	Ebonyi	Amavum Okue, Uvo LGA	Electric Powered	596	927
14	Ebonyi	Rice mill, Uvo LGA	Solar powered	207	331
15	Abakililk	Oba	Solar powered	517	826

Source: National Population Commission (NPC, 2022)

Population from 2006 to 2021 with annual growth rate of 3.2%.

$$\text{Sample Formula: } P = 2006 \frac{\sqrt[1+r^n]{100}}{100}$$

I = constant; r = growth; n = no. of years

Table 2: Technology used for Water Projects

Types of water structure	No. of community	Population	%
Electric borehole	9	6,581	66.3
Solar bore hole	6	3,339	33.7
Total	15	9,920	100

To ascertain the sample size, Fisher’s formula becomes handy;

$$n = \frac{pqZ^2}{d}$$

Where: n = the desired sample size; Z= standard normal distribution at the required confidence interval; p = proportion of the target population.

$$q = 1 - P$$

d = the level of statistical significant set.

If the P is not known in advance, 50% should be used

$$P = 0.5$$

$$q = 1 - P$$

Z= 1.96 at 95% confidence interval

$$N=1.96^2 \times 0.5 \times 0.5 / 0.5^2 = 384$$

The water projects in these communities are serving a population of 9,920. The target beneficiaries are less than 10,000, hence the final sample size (nf) using the following formula from Nworuh (2017).

$$nf= n/1 + n/N$$

$$\text{Therefore, sample size} = \frac{384}{1 + 384/9920} = 370 \text{ respondents}$$

Table 3 Sample Frame

Type of Water Project	Population	Sample size
Electric powered bore hole	6,581	240
Solar powered bore hole	3,331	130
Total	9,920	370

Hence, a sample size of 370 respondents was used. It was achieved via purposive sampling technique in selecting 6 key members from each of benefitting communities with public sector water projects.

Nevertheless, data were collected through both primary and secondary sources. The primary source is the questionnaire designed using 5-point Likert's scale. Questionnaire was the main tool used for collecting data. The questionnaire had five sections consisting of questions on demographic characteristics, community participation, water level of the area, technology used in extraction of water and the distance between the user and the water point. However, the secondary data sources include journals, textbooks, periodicals, projects report, etc.

In order to analyze the data collected, both qualitative and quantitative techniques were used. The data analysis techniques involved the use of both descriptive and inferential statistics. The descriptive statistics include mean, percentages, frequency tables and cross tabulation. The inferential technique includes the sample t-statistical test.

Ethical Consideration

Throughout this study, the ethical issues were up held to ensure the dignity of the participant is maintained. Major ethical issues of concern in this study include voluntary participating, informal consent, invasion of privacy and confidentiality. The objectives of the study were well explained to the respondents with an assurance that the data provided was to be used for academic purpose only and be treated with confidentiality.

Decision Criteria

Accept the null hypothesis, if the p-value is less than or equal to 0.05 level of significance. Otherwise reject the null hypothesis. This is based on the fact that the asymptotic level of significance is 5%.

Results and Discussions

A total of 370 copies of the questionnaires were administered to the target respondents. 317 well completed questionnaires were retrieved and use for the analysis. This 317 questionnaire retrieved represent 85.7% of the total respondents indicating high response rate from the target respondents.

Analysis of the Identified Factors that Influence the Performance of Public Sector Water Projects in the Southeast States of Nigeria.

The hypotheses formulated were tested using t-test at 5% level of significance. The generated t-test results via SPSS were displayed and analyzed below as follows:

H₀₁: Community ownership, participation and involvement do not influence the sustainability of public water projects in Anambra Imo River Basin Development Authority.

Table 4 Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error Mean
CO	317	18.3595	4.39672	.22857
PSWPP	317	36.7162	4.21161	.21895

The descriptive statistics result in Table 4.2 suggest that the average level of public sector water project performance (PSWPP) is 36.72 and that community ownership & involvement have a mean contribution of 18.3595 to the level of performance witnessed in Anambra-Imo River Basin water projects. This performance level of 36.7162 is low meaning that these public sector water projects have not really impacted positively on the lives of the beneficiaries. Hence, this study.

Table 5 T-test Result for Community Ownership & Participation and Public Sector Water Project Performance

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
CO	80.322	316	.000	18.35946	17.9100	18.8089
PSWPP	167.691	316	.000	36.71622	36.2857	37.1468

The t-test result in Table 5 used for hypothesis testing has a t-value of 80.322 which is significant at 0.000 level of significance. This implies that at community ownership and participation (CO) greatly influenced public sector water projects. The study rejects the null hypothesis and conclude that Community ownership and Involvement have significant influence on public sector water project performance.

However, Echeme (2017) had a similar result in his work on “Critical factors that hinder LEEMP development projects in Imo State”. It means that the benefiting communities may not have been adequately sensitized, hence were not involved in the planning and implementation of these water projects. However, such public sector requires that the beneficiaries should be involved in the project management processes. If they are not sensitized and involved in such project, they may create an uncondusive environment that affect the projects and this is the case with most projects embarked upon by AIRBA.

H₀₂: Water level of an area cannot affect public sector water project sustainability in Anambra Imo River Basin Development Authority

Table 6 T-test Result for the Water Level and Public Sector Water Project Performance

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
WL	73.504	316	.000	17.06757	16.6110	17.5242
PSWPP	167.691	316	.000	36.71622	36.2857	37.1468

The t-value of 73.504 in Table 6 is significant at 0.000 level of significance, implying that at 0.05 level of significance, geologic and hydrologic formation is significant. The study therefore accepts the alternative hypothesis and conclude that the water level (WL) can significantly influence the performance of public sector water projects. Boateng (2018) also revealed that low level of water is a major factor that constrained most underground water projects in Ghana and other West Africa countries. So it is evident that water level play significant roles in the implementation of water projects. However, the issue of water level is natural and should be considered at the planning stages of water projects in order to tackled it and stop it from affecting the performance of water projects, especially those undertaken by organizations like the Anambra/Imo River Basin Authority.

H₀₃: The technology used in extraction of water have no significant influence on the sustainability of public sector water projects in Anambra Imo River Basin Development Authority

Table 7 One-Sample Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error Mean
TU	317	18.9297	4.22156	.21947
PSWPP	317	36.7162	4.21161	.21895

The descriptive statistics result in Table 7 show that the average level of PSWPP is 36.72 and the type of technology used in the extraction of water has a mean contribution of 18.93 in the performance of AIRBDA water projects.

Table 8 T-test Result for Technology Use and Participation and Public Sector Water Project Performance

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TU	76.253	316	.000	18.92973	18.4982	19.3613
PSWPP	167.691	316	.000	36.71622	36.2857	37.1468

The t-value of 73.504 in Table 8 is significant at 0.000 level of significance, implying that at 0.05 level of significance, the technology used in extracting the water have significant influence. The study therefore rejects the null hypothesis and conclude that the technology used in the extraction of water have significant influence on public water sector project performance. This depicts reality as most water projects, especially in the public sector have suffered poor performance due to the crude technology applied in the execution of the project, hence affecting its delivery with respect to quality, time and cost objectives. The situation is that most operators of water projects still adopt the manual technique rather than the mechanize technique which is more effective and efficient in delivery of water projects.

H₀₄: The distance between the user and the water project location have no significant influence on public sector water project sustainability in Anambra Imo River Basin Development Authority.

Table 9 One-Sample Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error Mean
DB	317	8.6459	6.25050	.22097
PSWPP	317	36.7162	4.21161	.21895

The descriptive statistics result in Table 9 suggest that the average level of PSWPP is 36.72 and that the distance between the beneficiaries of the water projects and the location of the water projects (DB) have a mean contribution of 8.6459 to the level of performance.

Table 10 T-test Result for Distance between Beneficiaries & Water Location and Public Sector Water Project Performance

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
DB	1.381	316	.098	8.64595	8.2114	9.0805
PSWPP	167.691	316	.000	36.71622	36.2857	37.1468

The t-test result in table 10 reveals a t-value of 1.322 which is significant at 0.098 level of significance, implying that at 0.05 level of significance, the distance between the water projects and the beneficiaries of the project did not influence public sector water projects. We therefore accept the null hypothesis and conclude that the distance between the beneficiaries and water project location does not have any significant influence on the performance of public sector water projects. This is surprising because Afolayan (2016) have it that many communities have resisted any attempt to locate water facilities far from their neighborhood, thereby frustrating the successful delivery of such projects. However, the case is different for these public sector water projects executed by the AIRBDA. Improve technological development and knowledge through irrigation has solved the problem of distant location of water facilities from the beneficiaries.

2.0 CONCLUSION

The findings of the study have been summarized according to the four variables of the study namely: community ownership, involvement and participation, level of the ground water resources, technology used in extracting water and water project location.

This study reveals that community ownership, involvement and participation is low and has contributed negatively to the actualization of the public sector project objective in the communities. The Federal government and the management of AIRBDA must conduct orientation and user education on the need to protect and manage the water projects for sustainability. Proper

needs assessment of these public water projects must be done and considered before embarking on such project. Community ownership, involvement and participation must be high for any public sector water project to be successful and sustainable. People must see the project as their own. The project provider as in the case of AIRBDA must carry the community along and explain in detail the scope of the projects, the cost implication and also train people in the communities on the operation and maintenance of the water project in case of break down. There should be proper hand over and commissioning to mark end of life cycle of the project, in-between there should be total conviction to the communities that the project is 100% their own.

The study revealed that the level of ground water resources plays a significant role in the success of public sector water project in the communities under the study. Pre-investigation into the water level and ground water resources must not be ignored if the objective of the project must be achieved. Hydrogeological studies must be conducted by experts to ascertain water level before consideration of water projects are made. Water projects should not be left for quarks to operate. AIRBDA is a parastatal that boast of professionals and dynamic staff proficient in their chosen areas. Prior to sitting any public water project, a detailed investigation on the hydrogeology and ground water of the area must be carried out to ascertain availability of water in commercial quantity and quality before the choice of the location of public water project.

The study revealed that the technology used to extract water have significant influence on the performance of public sector water project in the communities under the study. The study also revealed that generating sets are mainly used in extracting water in the communities under the study and high cost of diesel makes some of the water project not functioning. For public water project to meet it objectives, the technology used must be simple to maintain and cost effective. There is no gain saying that the cost of extracting and maintaining water in some communities are very high. Something must be done to localize and minimize the cost to achieve the best project objectives.

The distance between the public sector water project in the communities under the study and beneficiaries show allow influence on the success of water projects in these communities. Common sense would have proved otherwise but the study revealed other intervention from the government agencies including AIRBDA in area of irrigation, nearness to streams also made it possible to reduce the water project to only drinking, thereby making the communities not 100% dependent on the water projects for all supply of their daily needs of water.

Hence, the study concludes that community ownership, involvement and participation, water level, technology used in extracting water and water location distance to the beneficiary have influence the effective performance of public sector water projects in communities under the study being covered and operated by AIRBDA.

In summary, the aim of public sector water project is to reduce the pain and suffering of the people with respect to access portable water. Despite the government effort in reducing demands for water through other means like irrigation. Water point should be as close to the peoples as possible. Water point location playing low significant in this study could be linked to poor awareness of community's ownership of public sector water projects. Most rural people see the

projects as government projects and as a result, are careless with the protection and management, hence unsustainable. When sitting public sector water projects, bureaucracy should be removed and the survey conducted to determine the most centralized and suitable point to site the project to reduce the suffering of the people.

REFERENCES

Afolayan, A. K. (2016) Community-driven Water Projects in Ibadan Metropolis, *International Journal of Personnel Management*, 6(3), July Edition, pp.46

Boateng, A.T. (2018) Constraining Factors of Underground Water Projects in West African Countries: A Case of Ghana, *International Journal of Construction Engineering*, 6(2), pp. 78-93.

Buffon, S.H. (2005) Enhancing private sector in rural water supply: An action-oriented study.

Cobbing, J. E. & Davies, J. (2010). Groundwater: returning to the sources planet earth. *Spring*.16-17.

Dosumu, O. & Aigbaiboa, C., (2017). Impact of design errors on variation cost of selected building projects in Nigeria. *Procedure engmanag* 196, 847-856.

Echeme, I.I. (2017) Critical Factors Hindering Successful Implementation of World Bank-Assisted Local Empowerment and Environmental Management Projects in Imo State, *Project Management World Journal*, Vol. VI, Issue IX, September, 2017, pp. 1-20.

<https://pmworldlibrary.net/wp-content/uploads/2017/12/pmwj65-Dec2017-Echeme-critical-factors-affecting-successful-world-bank-leem-projects.pdf>

Echeme, I. I., Okwara I. D., Okangba, S. (2022). Models for the Sustainability of World Bank-Assisted Development Projects in Nigeria, *Innovations*, Number (71), December.

Fielman, N. (2011). The role of the community ownership and management strategy towards sustainable access to water in Ghana: A case of Nodoroli district. *Journal of sustainable development*, 14(3).

Frimpong, T.G. (2003) Sustainability of underground water projects in Ghana, *Journal of International Studies*, 4(1). pp. 35

Gleitsmann M. B. (2005). The importance of community involvement in the planning and design phases of rural supply development project in Koro region of Mali, West Africa.

Gowan, J. & Mathew, R. (2005). The importance of management practices in project performance: An empirical study, *Journal of Enterprise Information Management* 18(2). 235-355.

Harvey, P.A. & Reed, R.A. (2007). Community-managed water supplies in Africa sustainable or dispensable? *Community Development Journal* 42(3): 365.

Hwang, D., Windahl, C., & Seidel, R. (2010). A Project Contingency Framework Based on Uncertainty and its Consequences, *Academia Journal*, 8(3), pp.256.

Ijewereme O. (2015). Anatomy of Corruption in the Nigeria Public Sector. *SAGE Open* 5, pp.1-6.

Judger, K. & Muller R. (2005). A retrospective look at our evolving understanding of project success, *Project Management Journal*, 36(4), 19-31.

Kayagu, S, & Basiago, A. (2006). Economic, social and environmental sustainability in development urban planning practices. *Environmentalist*, 19(2), 145-161.

Kennerly, A.J. (2002) Sustainability in project management. A literature review and impact analysis. *Social Business* 4(1). 63-96.

Khan, M.S. Khan, I., & Akhtar, B.Y. (2014). Styles of leadership and its impact upon the project success. *Public Policy and Administration Research*, 4 (11), 48-52.

La Chapelle, P. (2008). Community Development: *Journal of Community Development Society*, 39(2), 208.

Love, P.E.D, Edwards, D.J. & Wood, E. (2011). Loosening the gordian knot: The role of emotional intelligence in construction. *Engineering, Construction and Architectural Management*, 1 (18), 50-65.

Mackenzie D. & Isah R, (2005). Household water delivery options in urban and rural India. Working paper No. 224.

McIvor C. (2008) Community managed supplies in Africa: Sustainable or Dispensable? *Community Development Journal* 42(3): 365.

Miner W. & Greer S. (2007). The concept of community: Readings with interpretation. New Jersey, Adlene Transaction.

Morfaw, J. (2014) Fundamentals of project sustainability. Paper presented at PMI Global Congress 2014. North America, Phoenix, AZ, Newton Square PA: Project Management Institute.

Nwankwoala H.O. (2010). Localizing the strategy of achieving rural supply and sanitation in Nigeria. *African Journal of Environmental Science and Technology*.

Nweze, N. (2016). Failure of public infrastructure projects in Nigeria: Causes, Effect and Solution, textile. *International Journal of Management* 2(2), 1-20.

Nworuh, G.E. (2017) *Fundamentals of Applied Quantitative Techniques for Management Decision*, Bon Associates – HRDC, Nigeria, pp. 90.

Ochelle J.H (2012). Economic sustainability of the economy. Concept and indicators. *International Journal of Sustainability Development*, Vol 8 Nos 1/2, pp 47-64.

Okuntale, P.I. (2015). An integrated Geology and Geophysical Exploration Techniques for ground water in Basement Complex of West Central part of Nigeria. *Journal of Natural Association of Hydrogeological water rouse*, 10(1), 46-49.

Onyeka, U. (2024) Appraisal of the Sustainability of Public Sector Water Project Performance in Anambra Imo-River Basin Development Authority, A Master's degree research thesis presented to the Postgraduate School, Federal University of Technology, Owerri, pp.67.

Pourrostann, T., & Ismail, A., (2011). Significant factors causing and effects of delay in Iramma Construction Projects. *Australian Journal of Basic and Applied Sciences* 5(7) 15-450.

Sutton S. (2025). *The Sub-Sahara Potential for Household level water supply improvement. Maximizing the benefit from water and environmental sanitation*, 31st WEDC conference, Kampala, Uganda WEDC Laughbourogh University UK.

UNICEF (2013). Millennium Development Goals Progress Report. New York.

UNICEF (2018) Bureau of energy efficiency and Green Buildings. *International Journal of Research* 1(3), 23-32.

Yu, A.G. Flech, P.D., & Bowers J.A. (2005). Developing a value proposal for assessing project success. *International Journal of Project Management*, 23(6) 428-436.

Zhan. L., & Fan W. (2013) Improving performance of construction projects. A project manager emotional intelligence approach. *Engineering Construction and Architectural Management* 20(2) 195-207.

Zuofa, T. 2014. Project failure: The way forward and Panacea for development. *International Journal of Business and Management*, 9(11).

APPENDIX

List of Studied Water Projects and Their Performance and Sustainability Levels

S/ N	STATE	LOCATION	TYPE	YEAR OF AWARD	DUE DATE	STATUS
1	Imo	Omene square , Isiogwu village, Ideato South LGA	Solar powered	2011	2011	Not functioning
2	Imo	Amigbo Nguru, Ngor Okpala LGA	Solar powered	2014	2014	Not functioning
3.	Imo	Umukabia Okwuato, Aboh Mbaise LGA	Electric powered	2015	2015	Function
4	Abia	Umuigbede Obinulo, Ngodo Isiochi LGA	Electric powered	2015	2015	Not function
5	Abia	Market Square old Umuahia, Umuahia North LGA	SOLAR powered	2016	2016	Functionin g
6	Abia	Nkwokoro Umuoleke, Isiala Ngwa South LGA	Electric powered	2016	2016	Not function
7	Anambra	Emenike Compound Okuzu, Oyi LGA	Electric powered	2017	2017	Functionin g
8	Anambra	Ogbefere Market Okpoko, Ogbaru LGA	Solar Powered	2017	2017	Not function
9	Anambra	St. Augustine Anglican Church Ubiama, Olumba North LGA	Electric powered	2017	2017	Not functioning
10	Enugu	Central School Ugbene –Ajima, Uziouwani LGA	Electric powered	2018	2019	Not functioning
11	Enugu	Aluka town, Nsukka LGA	Electric powered	2017	2017	Not functioning
12	Enugu	Aguibechi Autonomous Community, Igboeze North LGA	Electric Power	2013	2013	Not functioning
13	Ebonyi State	Amavum Okue, Uvo LGA	Electric Powered	2016	2016	Functionin g
14	Ebonyi	Rice mill, Uvo LGA	Solar powered	2019	2019	Functionin g
15	Abakililki	Oba	Solar powered	2019	2019	Not functioning

Source: Desk/Field Study Data (2026)

About the Authors



Uche Godswill Onyeka

Imo State, Nigeria



Uche Godswill Onyeka is the MD/CEO Transparent projects services Ltd, Owerri Imo State. He was born on the 1st of June 1972 at Nkwerre in Nkwerre local government area of Imo State Nigeria. He attended central school Nkwerre for his primary school and St Augustine Grammer School Nkwerre for his secondary school and graduated in 1988. He obtained a BSc in geology from the University of Nigeria in 1996. He worked brief with Interdrill oil services company in Warri, Delta State. He went into full-time geologic practice with core interest in water projects. He later enrolled in the Federal University of Technology Owerri where he obtained his post graduate diploma and MSc degrees in Project Management Technology. He is happy married man with four sons.



Ibeawuchi Ifeanyi Echeme, PhD

Owerri, Imo State Nigeria



Ibeawuchi Ifeanyi Echeme is a lecturer in the department of Project Management Technology, Federal University of Technology, Owerri. Echeme has a B.Tech, MSc, and PhD in Project Management Technology and has published more than Sixty (60) articles in both international and national reputable journals. Dr. Echeme has published a textbook on Project Time, Cost and Quality Management. He is a Chartered member of Chartered Institute of Project Managers Nigeria (CIPMN), Chartered member, Association of Practicing Project Managers of Nigeria (APPMON), Certified Project Director (CPD) and a member of International Project Management Professionals (IPMP). Dr. Echeme has presented papers in conferences and workshops within and outside Nigeria. He can be contacted through; ibeecheme@yahoo.com



Emmanuel C. Ubani, PhD

Imo State, Nigeria



Prof. Emmanuel C. Ubani holds BSc. and MEng in Industrial Engineering; PhD in Project Management Technology. Former Head, Department of Project Management Technology, and former Associate Dean, School of Management Technology, Federal University of Technology Owerri. He is a member of Nigeria Society of Engineers (MNSE), Fellow Institute of Industrial Administration (FIIA). He has published widely in both International and local Journals.