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Assessment of Perceived Performance of Solar-Powered Borehole Projects in Nigeria

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Abstract: This study aimed at the assessment of the perspective of the people of Kano-south senatorial district, Nigeria on solar powered borehole projects. This research sought to establish the performance of solar-powered boreholes in terms of presence, their importance, their performance, and maintenance culture as well as provide solutions to possible problems that the senatorial district may be encountering in the usage of these amenities to ensure good sustainability. The survey research method was adopted for this study, and data were collected from 400 people who represented the sample size. The analysis of the data collected showed that 88.6% of the respondents affirmed the presence of solar-powered boreholes in the study area, which is in line with the hypothesis analysis. Similarly, the result showed that although the solar-powered borehole projects have positive impacts on the standard of living of the populace, most of these amenities are not functional due to the low regularity of borehole maintenance. Based on the views of the end-users, it was recommended that the involvement of community leaders and other end-users, proper training of the end-users, provision of channels of reporting damages, the building of more solar-powered boreholes and adequate provision for maintenance are some of the ways to ensure better sustainability of solar-powered boreholes projects in the senatorial district.

Keywords: Solar-powered; borehole; projects; functionality; impact assessment

1. Introduction

The provision of socio-economic activities to the populates of a nation is both the responsibility of the government and the people, however, in most cases, the government is considered the major party with this obligation (Ozbudun, 2015). Development in rural communities in the bid to meet the need of the people by providing the social-economic infrastructure in these regions can be done with or without the support of the government (Uguru & Meldrum, 2019). Usually, constituency projects are carried out by the Federal Government of Nigeria (the executive) on behalf of the National Assembly (the legislature) since it is the duty of the national assembly to approve policy while it is the duty of the Federal Government to implement those policies as indicated in the annual budget (Udefuna *et al.*, 2013).

The idea of Nigeria's senatorial district is the division of a territorial into parts so as to produce a senator which will be charged with the responsibility of providing the representation to the people

of that part in the Upper Chamber of Nigeria's bicameral legislature. The major responsibilities of the Upper Chamber of Nigeria's bicameral legislature are the introduction of legislation bills and the provision of checks and balances of the other elements of the Federal Government of Nigeria (Chilaka *et al.*, 2021; Daudu & Fagbadebo, 2019). In the allocation of funds for the provision of social amenities in Nigeria, the senatorial district methods are usually employed by the Federal Government of Nigeria. Hence, the senatorial district of Nigeria can be described as a viable method for correspondence between the government on one hand and the citizens on the other hand with the intention of advancing socio-economic development in all regions without neglecting any (Muheeb, 2019).

Constituency projects are those works, or undertakings executed by either the federal government or in some cases state government usually as a consequence of the support of such constituent by providing representation to the Federal Government (Oni, 2013). These projects include access to safe and portable drinking water, sanitation facilities, health care facilities, empowerment programs to alleviate poverty, provision of employment opportunities, etc. The idea of constituency project is not only found in Nigeria as it is found in several democracy-practising countries, though it is usually referred to as Constituency Development Projects (CDP) (Udefuna *et al.*, 2013).

The provision of sustainable and healthy water in developing countries is a major concern at various governmental levels in which Nigeria is not an exception (Kernick, 2014; Uguru & Meldrum, 2019). Water is a precious natural resource that sustains life in all of its forms and although the 71% of the earth is made up of water, the availability of good and healthy water is scarce and consuming the unhealthy water leads to adverse health challenges such as kidney and gastric disorder, typhoid, diarrheal cholera, etc. Water-related diseases are the most critical health-related problems associated with people in developing countries and it represents 80% of all health issues (Etim *et al.*, 2021; Kernick, 2014; Olalemi & Akinwumi, 2022).

With the nature of the deleterious health implication of consumption of highly contaminated water, especially the well-dung and the natural water bodies, borehole water is considered the next safe water especially for a large population (Shimamura *et al.*, 2022). The popularly found borehole water in most developing communities is the electrically pumped ones, however, the epileptic power generation and distribution in Nigeria are affecting the performance of these boreholes which results in the lots of abandoned boreholes in our communities (Yorkor & Leton, 2017). This and many more were the reasons behind the shift from the electrically-powered borehole systems to the solar-powered borehole systems in our communities. However, the introduction of solar-powered boreholes did not eliminate existing problems in the provision of healthy water to the people. Some of these problems include a lack of quick access to spare parts and repairs, bad maintenance culture, and an inadequate number of solar-powered boreholes for a large number of people (Oloruntade *et al.*, 2014).

Problems regarding the implementation and sustainability of constituency projects, especially in rural communities, despite the large fund allocated in the budget for the provision of some essential amenities for the people is main push of this study. A recent study according to UNICEF shows that only 26.5% of the population of Nigeria has access to clean water as well as good sanitation facilities (UNICEF, 2019). Yet, an average of US$15 million is allocated to water supply annually for each states (Oloruntade *et al.*, 2014).

Therefore, to put into context, due to problems associated with solar-powered boreholes as a community project and the slow progress in the implementation and sustainability of these projects, this study aims to assess the perspective of constituents of Kano-south senatorial district, Nigeria on solar powered borehole projects. In line with the aim, research questions on the performance as a function of adequacy, functionality and impact of solar-powered borehole projects in the senatorial district were developed. Also, research hypotheses in that line of thought were developed and tested. The main contribution of this study is in the provision of an on-site assessment of constituency projects in a senatorial district of Nigeria based on the perspective of the end-users of these projects, and proffering solutions to some of the challenges identified in

terms of functionality of these projects which can be applied to similar case studies. The introduction of this study is covered in Section 1, literature review in Section 2, research methodology in Section 3, results and discussion in Section 4, and conclusion in Section 5.

2. Literature review

2.1 Solar-powered boreholes

The quintessence of solar-powered water pumps includes the change of the sun's radiation energy into valuable pumping energy to either give water dynamic energy or potential energy when being put away in a reservoir or storage medium (Short & Mueller, 2002). This innovation, similar to wind and diesel power, can only be viewed as a proper innovation for providing clean water on the off chance that it is very well executed in such a manner as, that it is sustainable by the community they are located and helps in the improvement of the well-being of the people in that community (Choudhary *et al.*, 2017).

In rural communities where access to the national grid is difficult and not financially savvy, independent systems, such as those structured around solar-powered energy give a decent and suitable choice for water provision (Dursun & Ozden, 2012). Studies have proved that even with the presence and access to the national grid, the utilization of solar-powered pumps or boreholes is an increasingly feasible choice (Kumar *et al.*, 2020).

A common solar-powered pump/borehole, as shown in Figure 1, comprises a solar array which changes over sunlight into usable power, a controller to direct activity to give energy to an electric motor which thusly controls a pump that lifts the water from the water source to the surface.

However, the arrangement of this system varies from place to place and individual. Either an Alternating Current (AC) inverter is required to change over the DC power obtained from the solar boards into AC power, as utilized by most electric pumps, or a Direct Current (DC) inverter if a DC power pump is being utilized, using the DC power from the boards directly (Senthil Kumar *et al.*, 2020). Variation in the system also exists in terms of motors being used as powered by the solar panels. The DC-powered brushed and brushless motors can be used; however, the brushless DC motor is a better option for solar-powered pumps because they have better power matching with the photovoltaic (PV) panels as well as lower friction which makes them require less start-up power. Similarly, brushed DC motors are not preferred because they regularly need brush replacement which makes them have a high maintenance cost (Aliyu *et al.*, 2018).

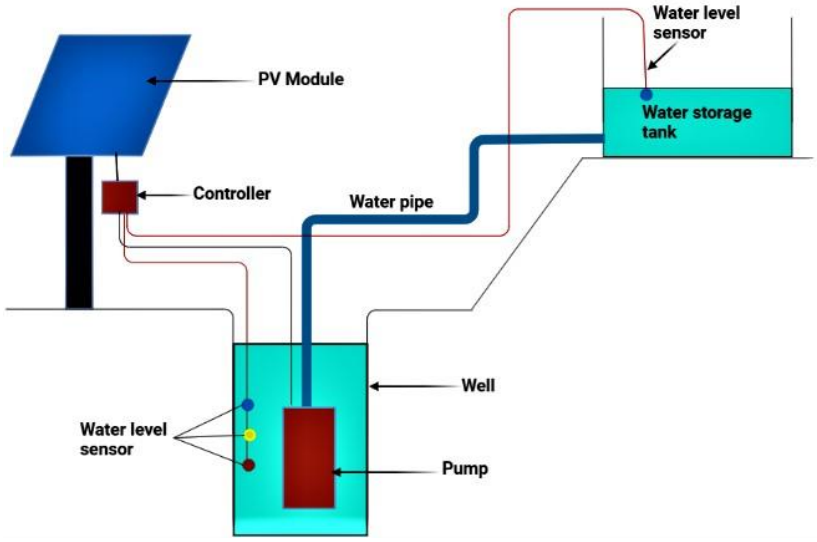

Figure 1. General Schematic of Solar-Powered Pump/Borehole (Girma *et al.*, 2015)

In the process of selecting the components of a solar-powered pump/borehole, it is important to carry out proper calculations so that these components match with each other, otherwise, unmatched components result in an inefficient overall system even if the components are efficient individually (Short & Mueller, 2002). The solar-powered pumps themselves can likewise differ with the most widely recognized one being the submerged multistage centrifugal pump which is regularly found in the town water supply (Aliyu *et al.*, 2018). This type of solar-powered pump is portrayed by its simple installation and equipment protection due to being submerged pumps and can be AC or DC. The disadvantage, however, is that maintenance of this category of the pump is not easy since it is submerged (Muhsen *et al.*, 2017). The schematic of the solar-powered submerged multistage centrifugal pump is shown in Figure 2.

In the bid of overcoming the maintenance challenge of solar-powered submerged multistage centrifugal pumps, submerged pumps with surface mounted motors are being used which give easy access for maintenance as shown in Figure 3.

Another category of the solar-powered pump in use is the reciprocating positive displacement pumps which are highly suitable to deliver the high head, applicable for low flow applications, and

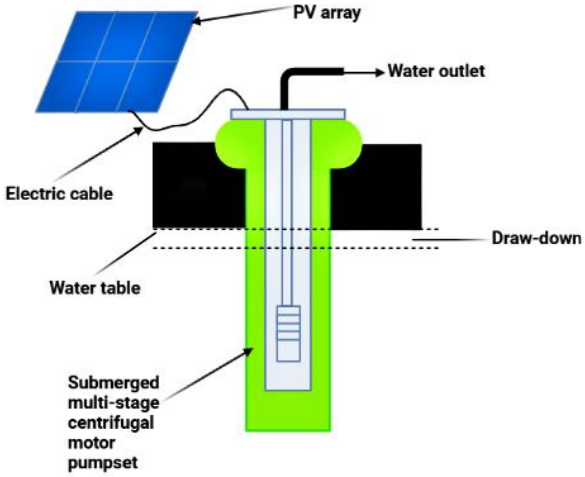

Figure 2. Schematic of Solar-Powered Submerged Multistage Centrifugal Pump (Muhsen *et al.*, 2017)

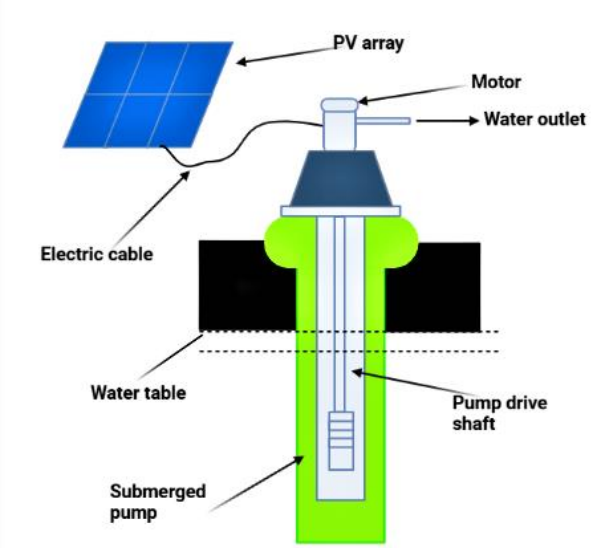

Figure 3. Schematic of Submerged Pumps with Surface Mounted Motors (Muhsen *et al.*, 2017)

do not require large above-ground components and power controllers (Muhsen *et al.*, 2017). The schematic of the reciprocating positive displacement solar-powered pump is shown in Figure 4.

2.2 Review of related works

Table 1 gives the review of related past works in terms of the author(s), year of publication, aim of study, methodology used, and research findings.

The findings of the review literature showed that deficiency of resources, unnecessary duplication and overlap in organizational functions, uncoordinated activities in the water-related agencies at the Federal, State and Local Government levels, and lack of effective water and environmental protection laws are the major problems of ineffective water policies in developing communities (Gbadegesin & Olorunfemi, 2007). Furthermore, in cases where the participation of the community in the implementation of the constituency project was good, the people involved were only the influential ones (Nyaguthii & Oyugi, 2013). These have resulted to constituency projects not having significantly impact on infrastructure development in these areas (Ezeobi, 2021).

In terms of effective implementation and maintenance of constituency projects, applying monitoring and evaluation tools has proven to enable the completion of projects in the stipulated time (Mwangu & Iravo, 2015; Sulemana *et al.*, 2018). Other techniques include project planning, community participation, monitoring and evaluation, and training are the major determinants responsible for effective implementation of constituency development fund projects (Chesiyna & Wanyoike, 2016). The development of national policy, and if necessary, legislative approach, is another way to address the problem of project failure in developing societies (Eja & Ramegowda, 2020).

From the review of related past works, it was observed that there has been no study that considered the functionality of solar-powered borehole projects as constituency projects despite the huge allocation of budget to these projects. Furthermore, most of the constituency projects in this review considered only the completion phase of these projects, without covering the scope of in-service functionality of these projects.

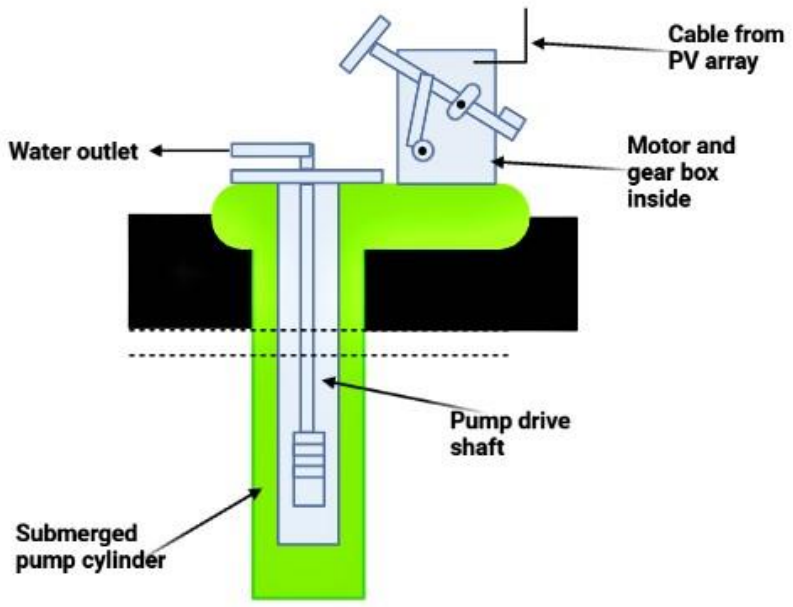

Figure 4. Schematic of Reciprocating Positive Displacement Solar-Powered Pump (Muhsen *et al.*, 2017)

Table 1. The review of related literature

Literature	Aim	Methodology
Gbadegesin and Olorunfemi (2007)	Assessment of rural water supply management in selected rural areas of Oyo State, Nigeria	Descriptive research design
Nyaguthii and Oyugi (2013)	Influence of community participation on successful implementation of constituency development fund projects in Kenya: case study of mwea constituency	Descriptive research design
Ngacho and Das (2014)	A performance evaluation framework of development projects: An empirical study of Constituency Development Fund (CDF) construction projects in Kenya.	Descriptive research design
Mwangu and Iravo (2015)	How Monitoring and Evaluation Affects the Outcome of Constituency Development Fund Projects in Kenya: A Case Study of Projects in Gatanga Constituency.	Descriptive research design
Chesiyna and Wanyoike (2016)	Determinants of Effective Implementation of Constituency Development Fund Projects in Baringo Central Constituency, Kenya	Descriptive research design
Kalu and Chikwe (2017)	Political Economy of Constituency Projects in Imo State (2011-2015).	Descriptive research design
Sulemana *et al.* (2018)	An assessment of stakeholder participation in monitoring and evaluation of district assembly projects and programmes in the Savelugu-Nanton Municipality Assembly, Ghana	Descriptive research design
Khaemba and Sang (2020)	Sustainability of Constituency Development Funded Projects In Kanduyi Constituency, Bungoma County, Kenya	Descriptive research design
Eja and Ramegowda (2020)	Government project failure in developing countries: a review with particular reference to Nigeria	Review paper
Kanyesige (2021)	Internal Stakeholder Engagement, Organizational Support, Project Team Efficacy and Project Success. A Case of USAID aided Projects in Uganda.	Descriptive research design
Ezeobi (2021)	National Assembly Constituency Projects and Infrastructural Development in Anambra State, Nigeria, 2011-2015	Qualitative research design

3. Research methodology

The survey research method was adopted in the current study. It is defined as collecting data by sending a questionnaire to relevant persons (Shah *et al.*, 2021). In this case, the relevant persons are the end-users of these solar-powered boreholes.

The sample size (SS) used for this research with a total population of 3,859,300 constituents was determined using Taro Yamane's formula as given in Eq. (1).

$$SS = \frac{N}{1 + Ne^2} \tag{1}$$

Here, N is the finite (known) size of the population, and e is the sampling error (taken as 5%). Hench, the sample size of 400 respondents was obtained and the questionnaires were shared among them.

A blend of primary and secondary data collection was adopted for this study due to its nature. Precedence was given to primary data sourced through hard copies questionnaire designed for that purpose. The primary data sources were obtained directly from the Kano-south senatorial district within December 2021 and January 2022 and this process was supervised by two of the authors and consisted of copies of the questionnaire distributed and administered to the 400 people as obtained from the sample size. Focus was placed on the people who were available when the researchers visited the senatorial district. Care was taken in making sure that all the 400 questionnaires were filled and the people in the senatorial district were guided on the process. The

questionnaire was designed and formulated based on the stated hypothesis. The questionnaire was divided into two sections;

Section A: contains demographic information such as gender, age group, academic qualification, occupation and name of local government (4 questions).

Section B: contains the respondent's opinion about the assessment of the performance of the federal constituency solar-powered borehole constituency project in the district through the use of direct questions (16 questions). The data was collected using 5-point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*. These questions were obtained from previous studies of Ngacho and Das (2014), Chesiyna and Wanyoike (2016) and Kalu and Chikwe (2017).

Inferential statistics were employed in the analysis of the data collected through the use of frequency counts and percentages using the Microsoft Excel (Version 2019) software. In answering the research questions, the mean respondent and standard deviation of the respondents were used. However, in the analysis of the research hypothesis, using the SPSS (Version 26) Software, the independent one-sample t-test was used. Independent one sample t-test determines the existence of a statistical difference between the know or hypothesized population mean and the sample mean based on the significance level. In this study, a significance level of 5% (0.05) was adopted.

4. Results and discussion

4.1 Demographic information of the respondents

Information about the gender, age group, academic qualification and occupation of the populace of the district based on the sample size are shown in Table 2.

From Table 2, the gender distribution of the study area showed that the majority of the responders were male (91.75%) while only 8.25% of the responders were female. Furthermore, it was observed that the age group distribution of the respondents had a maximum percentage of 30-34 years (50.75%), while the age group of 25-29 years, 45 years and above, and up to 24 years had a close range of 17.5%, 13.75%, and 12.25% respectively. However, the age group of 35-39 years had the least representation of 1%.

Table 2 also shows the distribution of academic qualifications of the respondents in which the academic qualification with the highest record was the SSCE (25.5%) and OND/HND (21.25%) qualifications. The "others" category of academic qualification had a record of 19.75% which included respondents without any form of formal education and the respondents with handwork. About 12.5% and 11.5% of the respondents had Primary education and B.Sc/B.Ed education respectively. However, none of the respondents had an M.Sc qualification. Also, the result shows that the majority of the respondents (43.25%) are Business Owners or Traders, 17% are Civil Servants, 11.5% are Community Leaders, and 6.25% are unemployed. The result also showed that 22% of the respondents were categorized under the "others" occupation group which included occupations such as farmers, hunters, etc.

4.2 Availability of solar-powered borehole projects in the district

From the result of the findings of this study (Table 3), the majority of the respondents (88.6%) affirmed the availability of solar-powered boreholes in their district, while only about 8.3% of the respondents disagreed with the availability of such projects in their community. This result is an affirmation of the mandate of the Ministry of Water Resources of Nigeria and Hadejia Jama'are River Basin Development Authority on providing accessible, and clean water to all regions through the establishment of the solar-powered boreholes (FMWR, 2018).

The result of the independent one-sample t-test on availability of solar-powered borehole projects (Table 4) showed that at the mean response of 1.832, variance of 0.733, the critical t-value value from the table ($t_{critical}$) at the degree of freedom of 1999 (1.646) is less than the calculated t-value (t_{calc}) of 34.8897. Based on the decision rule, since t_{calc} is greater than $t_{critical}$, the alternate hypothesis is accepted. This implies that there is adequate availability of solar-powered borehole projects in the senatorial district.

Table 2. The demographic information of the respondents

Variable	Number	Percentage
Gender		
Male	367	91.75
Female	33	8.25
Age Group		
Up to 24	49	12.25
25-29	70	17.5
30-34	203	50.75
35-39	4	1
40-45	19	4.75
45 and above	55	13.75
Academic Qualification		
Primary	50	12.5
SSCE	102	25.5
NCE	38	9.5
OND/HND	85	21.25
B.Sc/B.Ed	46	11.5
M.Sc	0	0
Others	79	19.75
Occupation		
Unemployed	25	6.25
Civil Servant	68	17
Business Owner/Trader	173	43.25
Community Leaders	46	11.5
Others	88	22

4.3 Functionality level of solar-powered borehole projects in the district

From the critical analysis of result of the findings of this study (Table 3), although the majority of the respondents (70.17%) affirmed on the functionality of solar-powered boreholes in their community majority of the respondents disagreed on the regularity of borehole maintenance. This result is attributed to lack of proper maintenance culture on the part of the monitoring bodies, difficulty in accessing spare parts of solar-powered boreholes, and insufficient technical know-how as posited by Short & Mueller (2002) and Kalu & Chikwe (2017) who observed poor maintenance culture in most constituency projects in Imo State Nigeria. This result is in agreement with the findings of Muhsen *et al.* (2017) who highlighted maintenance as one of the difficulties attached with the use of solar-powered boreholes.

The result of the independent one-sample t-test on functionality of solar-powered borehole projects (Table 4) showed that at the mean response of 2.487, variance of 0.823, the critical t-value value from the table ($t_{critical}$) at the degree of freedom of 2399 (1.645) is greater than the calculated t-value (t_{calc}) of 0.697. Based on the decision rule, since t_{calc} is less than $t_{critical}$, the null hypothesis is accepted. This implies that most of the available community solar-powered boreholes are not functional.

4.4 Impact of solar-powered borehole projects in the district

From the result of the findings of this study (Table 3), the majority of the respondents (82.15%) affirmed the importance and the positive impact that solar-powered borehole projects have on

Table 3. Responses to the questions on the availability, functionality, and impact of solar-powered borehole projects in the district

Responses	Availability		Functionality		Impact	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Strongly Agree	741	37.05	75	3.13	737	36.85
Agree	1031	51.55	1609	67.04	906	45.30
Undecided	62	3.10	272	11.33	192	9.60
Disagree	155	7.75	360	15.00	162	8.10
Strongly Disagree	11	0.55	84	3.50	3	0.15

Table 4. T-Test result on the hypothesis of the availability, functionality, and impact of solar-powered borehole projects in the senatorial district

	Mean	*Variance*	*Observation*	*Hypothesized Mean*	*Degree of Freedom*	*t-calculated*	*t-critical*
Availability	1.832	0.733	2000	2.5	1999	34.8897	1.646
Functionality	2.487	0.823	2400	2.5	2399	0.697	1.645
Impact	1.894	0.791	2000	2.5	1999	30.469	1.646

their standard of living. This result is in agreement with the objectives of Constituency projects which serves as instruments that bring about change and tend to solve a problem or utilize an opportunity (Alacevich, 2013). Also, this finding is in agreement with the stated visions of the Ministry of Water Resources of Nigeria in providing sustainable access to safe and sufficient water resources demands of the citizens of the country. The vision also entailed impacting the public health, food security, and poverty alleviation of the country (FMWR, 2018).

The result of the independent one-sample t-test on impact of solar-powered borehole projects (Table 4) showed that at the mean response of 1.894, variance of 0.791, the critical t-value value from the table ($t_{critical}$) at the degree of freedom of 1999 (1.646) is less than the calculated t-value (t_{calc}) of 30.469. Based on the decision rule, since t_{calc} is greater than $t_{critical}$, the alternate hypothesis is accepted. This implies that the solar-powered borehole projects have an impact on the well-being of the members of the community.

The limitations of this study are the scope of discussions is limited to Kano-south senatorial district; however, the findings can be implemented in similar settings, and some of the respondents had biased views, due to the political agendas associated with federal constituency projects.

5. Conclusion

This study evaluated the impact, functionality and availability of solar-power borehole projects as federal constituency projects in Kano-south senatorial district, Nigeria with a population of about 4million people. The hypothesized that the solar-powered borehole projects in the senatorial district are inadequate, not functional, and have no impact on the well-being of the members of the community. Using survey research method (in which questionnaire was distributed to relevant persons), inferential statistics and independent one-sample t-test was used for data analysis.

According to the results of the data analysis, the majority of respondents confirmed the presence of solar-powered boreholes in the research area, which is consistent with the hypothesis analysis. Similarly, the findings revealed that, while solar-powered borehole projects have a good impact on the population's standard of living, most of these amenities are not operational due to borehole maintenance's irregularity. It was recommended that the involvement of community leaders and other end-users, proper training of the end-users, provision of channels of reporting damages, building more solar-powered boreholes and adequate provision for maintenance are some of the ways to ensure better sustainability of solar-powered boreholes as a community project.

Appendix

The following is the research instrument that was used to collect data.

SECTION A: DEMOGRAPHIC INFORMATION OF THE RESPONDENT

Instruction: Please tick (√) appropriately the response as applied to you

1. Gender

Male ☐ Female ☐

2. Age Group

Up to 24 Years ☐ 25-29 Years ☐ 30-34 Years ☐

35-39 Years ☐ 40-44 Years ☐ 45 and Above ☐

3. Academic Qualification

Primary ☐ SSCE ☐ NCE ☐ OND/HND ☐

B.Sc. / B.Ed. ☐ M.Sc. ☐ Others (Please Specify) _____

4. Occupation

Unemployed ☐ Civil Servant ☐ Business Owner/Trader ☐ Community Leader ☐

Others (Please Specify) _____

SECTION B: ASSESSMENT OF THE PERFORMANCE OF SOLAR POWERED BOREHOLE CONSTITUENCY PROJECTS IN KANO-SOUTH SENATORIAL DISTRICT

Questions on availability of solar-powered borehole projects in the senatorial district					
	SA	**A**	**U**	**D**	**SD**
There are solar-powered borehole projects available in my local government area.					
As the population of my local government area increases, the number of solar-powered borehole projects increases over the years.					
I am satisfied with the numbers of solar-powered borehole projects in my local government area.					
The locations of the available solar-powered borehole projects available in my local government are strategically located to satisfy everyone					
During the rainy season where, solar radiation is not much, the solar-powered borehole projects are still available.					

Questions on functionality level of solar-powered borehole projects in the senatorial district					
	SA	**A**	**U**	**D**	**SD**
The solar-powered borehole projects available in my local government area are functioning to maximum capacity.					
The solar-powered borehole projects available in my local government area usually have regular maintenance.					
There is a proper channel available in reporting cases of damage to the solar-powered boreholes in my local government area.					
There is 24 hours access to water from the solar-powered boreholes in my local government area					
The solar-powered borehole projects in my local government are more reliable than the manual hand pump water boreholes					
There is a forewarning from the authorities if there will be maintenance activities on the solar-powered boreholes in my area					

Questions on impacts of solar-powered borehole projects in the senatorial district					
	SA	**A**	**U**	**D**	**SD**
The presence of solar-powered borehole projects has improved the standard of living of my local government area					
The presence of solar-powered borehole projects has solved the problem of drought and insufficient water in my local government area					
Solar-powered boreholes save time and energy than well or manual hand pump borehole					
Both the old and young can use the solar-powered boreholes in my local government area.					
The presence of solar-powered borehole in my local government area has enhanced my daily business, work or life.					

References

Alacevich, M. (2013). The World Bank and Development. *The Political Economy of the World Bank*, 1–10. https://doi.org/10.11126/stanford/9780804760652.003.0001

Aliyu, M., Hassan, G., Said, S. A., Siddiqui, M. U., Alawami, A. T., & Elamin, I. M. (2018). A review of solar-powered water pumping systems. *Renewable and Sustainable Energy Reviews*, *87*, 61–76. https://doi.org/10.1016/j.rser.2018.02.010

Chesiyna, P. K., & Wanyoike, D. (2016). Determinants of Effective Implementation of Constituency Development Fund Projects in Baringo Central Constituency , Kenya. *Impactjournals.Us*, *4*(4), 31–42. http://www.impactjournals.us/download/archives/--1462536462-4. Mgmt - Determinants of effective implementation of constituency.pdf

Chilaka, C. F., Obianua, O. U., & Idowu, A. H. (2021). The Legislature in Nigeria: Origin, Significance and Relationship with Other Arms of Government. *Two Decades of Legislative Politics and Governance in Nigeria's National Assembly*, 9–35. https://doi.org/10.1007/978-981-33-4455-6_2

Choudhary, P., Srivatava, R. K., & De, S. (2017). Solar powered induction motor based water pumping system: A review of components, parameters and control methodologies. *2017 4th IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics, UPCON 2017*, *2018-Janua*, 666–674. https://doi.org/10.1109/UPCON.2017.8251129

Daudu, I. A., & Fagbadebo, O. (2019). Public Participation in Legislative Oversight: A Review of Nature and Practice in Nigeria and South Africa. *Advances in African Economic, Social and Political Development*, 233–250. https://doi.org/10.1007/978-3-319-93509-6_13

Dursun, M., & Ozden, S. (2012). Application of Solar Powered Automatic Water Pumping in Turkey. *International Journal of Computer and Electrical Engineering*, *4*(2), 161–164. https://doi.org/10.7763/ijcee.2013.v5.471

Eja, K. M., & Ramegowda, M. (2020). Government project failure in developing countries: A review with particular reference to Nigeria. *Global Journal of Social Sciences*, *19*, 35–47. https://doi.org/10.4314/gjss.v19i1.4

Etim, M. A., Babaremu, K., Lazarus, J., & Omole, D. (2021). Health risk and environmental assessment of cement production in nigeria. *Atmosphere*, *12*(9). https://doi.org/10.3390/atmos12091111

Ezeobi, J. (2021). National Assembly Constituency Projects and Infrastructural Development in Anambra State, Nigeria, 2011-2015. *International Journal of Public Administration*, *6*(3), 2011–2015. https://doi.org/10.36758/ijpamr/v6n3.2021/09

FMWR. (2018). Parastatals in the Federal Ministry of Water Resources. *Federal Ministry of Water Resources*. https://waterresources.gov.ng/parastatals/

Gbadegesin, A. S., & Olorunfemi, F. (2007). *Assessment of rural water supply management in selected rural areas of Oyo State, Nigeria*. 55. https://www.africaportal.org/publications/assessment-of-rural-water-supply-management-in-selected-rural-areas-of-oyo-state-nigeria/

Girma, M., Assefa, A., & Molinas, M. (2015). Feasibility study of a solar photovoltaic water pumping system for rural Ethiopia. *AIMS Environmental Science*, *2*(3), 697–717. https://doi.org/10.3934/environsci.2015.3.697

Kalu, P., & Chikwe, J. (2017). Political Economy of Constituency Projects in Imo State (2011-2015). *International Journal of Contemporary*, *4*(4). http://www.ijcar.net/assets/pdf/Vol4-No5-May2017/04.pdf

Kanyesige, B. (2021). Internal Stakeholder Engagement, Organizational Support, Project Team Efficacy and Project Success. A Case of USAID aided Projects in Uganda. *Student's Journal of Health Research Africa*, *2*(9), 17. http://www.sjhresearchafrica.org/index.php/public-html/article/view/62

Kernick, G. (2014). *The Potential of Renewable Energy for Rural Groundwater Supply in the Elundini Municipality*. *June*. https://open.uct.ac.za/handle/11427/13262

Khaemba, C., & Sang, P. (2020). Sustainability of Constituency Development Funded Projects in. *International Journal of Project Management*, *2*(3), 124–141. https://www.serialpublishers.org/index.php/ijpm/article/view/126

Muheeb, I. O. (2019). The Trajectory of the Legislature, Lawmaking and Legislation in Nigeria. *Advances in African Economic, Social and Political Development*, 33–56. https://doi.org/10.1007/978-3-030-11905-8_3

Muhsen, D. H., Khatib, T., & Nagi, F. (2017). A review of photovoltaic water pumping system designing methods, control strategies and field performance. *Renewable and Sustainable Energy Reviews*, *68*, 70–86. https://doi.org/10.1016/j.rser.2016.09.129

Mwangu, A. W., & Iravo, M. A. (2015). How Monitoring and Evaluation Affects the Outcome of Constituency Development Fund Projects in Kenya: A Case Study of Projects in Gatanga Constituency. *International Journal of Academic Research in Business and Social Sciences*, *5*(3).

https://doi.org/10.6007/ijarbss/v5-i3/1491

Ngacho, C., & Das, D. (2014). A performance evaluation framework of development projects: An empirical study of Constituency Development Fund (CDF) construction projects in Kenya. *International Journal of Project Management*, *32*(3), 492–507. https://doi.org/10.1016/j.ijproman.2013.07.005

Nyaguthii, E., & Oyugi, L. A. (2013). Influence of community participation on successful implementation of constituency development fund projects in Kenya: case study of mwea constituency. *International Journal of Education and Research*, *1*(8), 1–16. http://www.ijern.com/journal/August-2013/49.pdf

Olalemi, A. O., & Akinwumi, I. M. (2022). Microbial health risks associated with rotavirus and enteric bacteria in River Ala in Akure, Nigeria. *Journal of Applied Microbiology*, *132*(5), 3995–4006. https://doi.org/10.1111/jam.15497

Oloruntade, A., Konyeha, S., & Alao, F. (2014). Assessing the Sustainability of Borehole as an Alternative to Pipe-borne Water Supply in Some Selected Communities in Akoko Area of Ondo State, Nigeria. *Ethiopian Journal of Environmental Studies and Management*, *7*(2), 881. https://doi.org/10.4314/ejesm.v7i2.8s

Oni, S. (2013). The Legislature and Constituency Representation in the Fourth Republic of Nigeria's Democratic Governance. *Ife Psychologia*, *21*(2), 232. https://journals.co.za/doi/abs/10.10520/EJC141125

Ozbudun, E. (2015). Social Change and Political Participation in Turkey. *Social Change and Political Participation in Turkey*, 1–258. https://doi.org/10.2307/2148536

Senthil Kumar, S., Bibin, C., Akash, K., Aravindan, K., Kishore, M., & Magesh, G. (2020). Solar powered water pumping systems for irrigation: A comprehensive review on developments and prospects towards a green energy approach. *Materials Today: Proceedings*, *33*, 303–307. https://doi.org/10.1016/j.matpr.2020.04.092

Shah, S. M. H., Nawaz, M., & Batool, A. (2021). Effect of Manpower and Resource Factors on Labor Productivity at House Building Projects in DHA Lahore. *Management Science and Business Decisions*, *1*(1), 12–20. https://doi.org/10.52812/msbd.14

Shimamura, Y., Shimizutani, S., Taguchi, S., & Yamada, H. (2022). Economic valuation of safe water from new boreholes in rural Zambia: A coping cost approach. *Water Resources and Economics*, *37*. https://doi.org/10.1016/j.wre.2021.100192

Short, T. D., & Mueller, M. A. (2002). Solar powered water pumps: Problems, pitfalls and potential. *IEE Conference Publication*, *487*, 280–285. https://doi.org/10.1049/cp:20020129

Sulemana, M., Musah, A. B., & Simon, K. K. (2018). An assessment of stakeholder participation in monitoring and evaluation of district assembly projects and programmes in the Savelugu-Nanton Municipality Assembly, Ghana. *Ghana Journal of Development Studies*, *15*(1), 173. https://doi.org/10.4314/gjds.v15i1.9

Udefuna, P. N., Jumare, F., & Adebayo, F. O. (2013). Legislative constituency project in Nigeria: Implication for national development. *Mediterranean Journal of Social Sciences*, *4*(6), 647–653. https://doi.org/10.5901/mjss.2013.v4n6p647

Uguru, P., & Meldrum, A. (2019). Water resource management and its impact upon public health in water scarce regions: A comparative study of Nigeria and Spain. *The International Journal of Environmental, Cultural, Economics & Social Sustainability*. https://www.researchgate.net/publication/334041386

UNICEF. (2019). Water, Sanitation, and Hygiene. *United Nations Children's Fund*. https://www.unicef.org/nigeria/water-sanitation-and-hygiene

Yorkor, B., & Leton, T. G. (2017). Solar Water Supply for Rural Communities in River State, Niger Delta of Nigeria. *International Journal of Energy and Environmental Research*, *5*(2), 1–17.