# American Journal of Development Studies (AJDS)

ISSN: 2837-6676 (ONLINE)

VOLUME 3 ISSUE 1 (2025)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Development Studies (AJDS)

Volume 3 Issue 1, Year 2025
ISSN: 2837-6676 (Online)
DOI: https://doi.org/10.54536/ajds.v3i1.4203
https://journals.e-palli.com/home/index.php/ajds

# Assessing the Risk of Dysfunction of Donor-Funded Water Projects in Uyo Metropolis

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Article Information

**Received:** December 07, 2024

**Accepted:** January 14, 2025

**Published:** June 12, 2025

**Keywords**

*Cox, Donor-Funded, Hazard, Uyo, Water*

## ABSTRACT

Using the cox proportional hazard regression analysis, the study assessed the risk of dysfunction of donor-funded water supply projects in Uyo Metropolis. The purposive non-probability sampling technique was adopted to select 20 donor-funded water projects. Data were generated through observations, interview sessions, and a questionnaire. It was discovered that, beginning from their various years of establishments, all donor-funded water projects in Uyo metropolis were dysfunctional as at the end of year 2024. The reasons for their dysfunction are the lack of funds, lack of maintenance, irrelevant technology, lack of community involvement, lack of community development, and vandalism. The Cox proportional hazard revealed that increase in the number of caretakers is not a risk factor, while households' average daily access, maintenance routine and community involvement are risk factors that led to the dysfunction of donor-funded water projects in Uyo metropolis. The caretakers, as well as the people that once had access to the water facilities, are worse hit. It was recommended that all dysfunctional donor-funded water projects should be resuscitated; routine and proper maintenance culture is needed once these water facilities are resuscitated; and there is need for concerted and determined efforts by the government and other donors to establish more water projects to cater for the growing population in Uyo metropolis.

## INTRODUCTION

A healthy lifestyle requires that people can access and afford adequate and quality water supply. An adequate quantity of water that meets safety standards has been viewed as an economic good important to health, survival, growth, and development (Venkatesh, 2009). Water remains critical to human life and one of the most valuable resources in the world (Adeleke *et al.*, 2023). The importance of water in development is evident in the United Nations' resolution on the 2030 Agenda for sustainable development where commitments were made in goal 6 to ensure access to water and sanitation for all. Improved water supply and sanitation and water resources management boost economic growth of countries and contributes to poverty eradication (Sanctuary *et al.*, 2007). This indicates that water supports economic productivity, and it is essential for development.

In a bid to ensure sustainable development through quality and adequate water supply projects, the government has taken the responsibility of establishing water supply projects to cater for the necessities of people. Moreover, international organisations such as the United Nations through its Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs) and other development Programmes, Non-Governmental Organisations (NGOs), and wealthy individuals in the society have not just complemented government's efforts in providing pipe-borne water projects but have engaged Memorandum of Understanding (MOU) that fosters beneficiaries' participation in water project executions that supports productivity and sustainable community development (Bassey *et al.*, 2013). Uyo metropolis, the capital of Akwa Ibom state, in Nigeria, has been a beneficiary to water supply projects undertaken by these donors. Such projects include the Community-Based Urban Development Programme (CBUDP), Millennium Development Goals – Conditional Grant Scheme (MDG-CGS), the state and local governments, and Non-Governmental Organisation.

Despite the laudable measures put in place by the government, some individuals, non-governmental organisations, national and international organizations, to provide adequate public water supply, most people do not have access to these public water projects. According to WaterAid (2015), more than 63 million people live in Nigeria without access to safe water because water services cannot be delivered quickly enough to cope with the rapidly growing population. Even though the country has adopted the community-based approach to the provision of water, communities are not always involved fully in all the stages of water provision (Amosah *et al.*, 2023). Uyo metropolis is one of the beneficiaries of donor-funded water projects. Hence, the more than 63 million people in Nigeria without access to safe water services suggest that people in Uyo metropolis may be affected. More so, it suggests that the water projects provided are not fulfilling the purpose for which they were established. Would it mean that some of these public water supply systems are dysfunctional, or some are functioning below expectations thereby depriving access to adequate and



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safe water supply? These observations necessitated a closer examination of the issue.

Specifically, the study seeks to first, investigate the functionality or otherwise of donor-funded water projects in Uyo metropolis. Second, the study ascertains the reasons why some of the donor-funded water projects in Uyo metropolis are not functioning. Lastly, the study ascertains the predicted risk of the dysfunction of the donor-funded water projects over a specified period of time, given some critical factors.

Several studies have undertaken research on the water company (Ubiam *et al.*, (2022); Ekpo and Umoh (2022); Ubi-Abai (2024); and Ubi-Abai (2024)) and self-water supply systems (Ikpeh *et al.*, 2017) in Uyo metropolis. This study limits its scope to donor-funded water projects for public use. Notably, the Akwa Ibom State Rural Water and Sanitation Agency (AKRUWATSAN) is the state agency that liaises with International Donor Agencies and NGOs on water sector related issues, and is currently supervised by the Bureau of Rural Development and Cooperative (Ikpeh *et al.*, 2017). The study is probably the first of its kind in Uyo metropolis. The study is significant because it sheds light on the current state of operations of donor-funded water projects. The study provides donors the needed information on the critical factors that affect the water projects in order to make vital decisions regarding the funding and how best to satisfy the water needs of water project beneficiaries in Uyo metropolis.

The study has five sections. Following the introduction is the literature review in section two. The review of literature outlines the theories behind the study, and provides a concise analysis of related research. Section three presents the methods adopted in the study. Section four analyses the data and section five concludes the study.

## LITERATURE REVIEW

### Theory of Public Good

The study is predicated on the theory of public goods. The theory of public good was postulated by Paul Samuelson (1954). It states that goods that are collectively consumed are non-rival and non-excludable. Goods are non-excludable in that it is difficult to keep people from consuming the goods once it has been produced, and goods are non-rival in that once it is produced for a person, additional consumers can consume at no additional cost. The non-rival goods are goods that are joint in consumption.

The integral part of Samuelson's (ibid) definition suggests that public goods are government-produced goods, which implies that goods with the characteristics of jointness in consumption and non-excludability ought to be produced by government. Most economists argue that a good has the characteristics of either jointness in consumption or non-excludability, and then, because that makes the good a public good, implies that the good should be produced in the public sector.

Samuelson argued the merits of public-sector production of public goods when he first formalised his theory of public goods in his The Pure Theory of Public Expenditure. He argued that there is no good revealed-preference mechanism for public goods, so they will not be produced efficiently, if at all, in the private sector. Hence, he implied that public-sector production is required for efficiency (Hanemann, 2006).

### Failed Water Aid

The study also analyses the dimensions of sustainable water aid by Douglas (2010). The first dimension of the sustainable water aid is the failed water aid. Douglas (2010) analysed the failures in water aid that are documented by the mass media. During the water decade of 1981 to 1990, the United Nations set a goal to provide everyone in the world with water of adequate quality and quantity. However, this approach was not successful in developing countries. The solutions were not technologically relevant to rural, developing countries because of the high initial capital cost, the operational complexities of high-tech solutions and the scatter of communities within the developing world. By the mid-1980s, the focus shifted away from urbanization towards simpler hand pumps and wells. The initial results were successful. However, when the hand pumps started breaking down, the systems were quickly abandoned by the communities rather than fixed. Non-governmental organisations have also contributed to the supply of public water systems. They have experienced the same lack of sustainability in water aid due to irrelevant technologies and a lack of community involvement. Much of water aid has also been unsuccessful at empowering communities to become independent and self-sufficient. Hence, most water projects fail because most communities are not educated to take responsibility of their own water system and circumstances. In as much as failures in water aids have existed, there have been successful efforts in water aid and community development – a second dimension of the sustainable theory of water aid.

### Theory of Water Aid

The second dimension is the theory of water aid. Douglas (2010) explained the successful efforts of science in devising philosophies on water aid. Forums and conferences on international water development helped continue to shape the new paradigm of water aid. The theory of water aid hinges on the fact that water projects that have successfully served their purposes for years stem from the fact that technologies are relevant and upgraded, community involvement is paramount. Here, water aid has been successful because most communities are educated to take responsibility of their own water system and circumstances. Additionally, in 2000, one of these millennial goals was stated "to halve, by 2015, the proportion of people who are unable to reach or to afford safe drinking water" (United Nations, 2009). Spurned by the MDGs, the UN decided to give the water decade idea another try and proclaimed that 2005-2015 would be the International "Water for Life" decade. It focused on community involvement and education, with specific priority placed on Africa's needs. (Savage *et al.*, 2008).

**Empirical Overview**

Few studies have been carried out on donor-funded water projects. This subsection focuses on research related to pipe-borne water projects, especially in Uyo metropolis. George *et al.* (2010) examined the level at which people have access to privatized water services in Kisumu Municipality, in Kenya using a cross-sectional survey and purposive sampling of 367 households. The Kenyan study showed that the percentage of households that had access to water supply within a 200-metre distance was 77.1%. However, 25% of the households had access to the minimum recommended 50 litres; and 65.6% of the basic water requirements of the residents were met. The study concluded that people's accesses to water services were reduced due to inadequate investment in water infrastructure and the low level of households' income.

Amori *et al.* (2012) assessed the major problems that affect residents in Iju-Ishaga southwest, Nigeria on the distribution of public water supply. Data were collected from 240 respondents (133 males and 107 females) in eight wards of the local government through the use of questionnaires. The study employed the use of frequency counts and t-test statistic in analysing the problems affecting the distribution of public water in the study area. It was established that the respondents believed strongly that the distribution network is faulty and hence the problem of inadequate water supply and the increasing incidents of water scarcity in the area.

In order to determine households' access to water supply in Yenagoa, in terms of quality and quantity, Odafivwotu and Abel (2014) collected samples from 15 boreholes in 15 neighbourhoods. Data were collected using the systematic sampling technique. The findings revealed that the quality and quantity of water supply in Yenagoa were inadequate. The findings also showed that 29.28% of the respondents used below 20 litres of water per capita per day, despite the increase in wells and boreholes, and the short distances to major sources of water supply. This was attributed to high cost of water supply, that averaged N4,500, per month, compared to the monthly minimum national wage of N18,000.

Eja *et al.* (2020) assessed the variation in existing domestic service level of pipe-borne water supply and associated challenges among communities in Uyo Capital City, Akwa Ibom State, Nigeria, using a multistage sampling technique. A total of 400 people in geographical locations responded to questions from the questionnaire. Subsequently, they used a one-way analysis of variance to test a hypothesis; and it was discovered that existing service level of pipe-borne water does not differ significantly among communities in the study area. Their study recommended that water distribution network and supply should be expanded to all the communities within the study area.

Ubiam *et al.* (2021) investigated the water supply provisions and the challenges faced in peri-urban areas of Uyo metropolis. They sampled a total of 330 households using the cluster sampling technique. Data were described, analysed and presented using percentages and frequencies. Their study revealed that there was no policy instrument for the extension of water supply infrastructure in these zones. The major challenges encountered were lack of funding, obsolete infrastructure, service unreliability, absence of electricity to pump the water. Their findings further revealed that majority of households depend on alternative water sources which may not be good for consumption resulting in serious public health concerns.

In summary, the few studies that have examined water projects in Uyo metropolis have not considered the duration of the risk of dysfunction of pipe-borne water projects and the critical factors that affect such risk. This study, probably the first of its kind in Uyo metropolis, seeks to contribute to knowledge by examining the risk of dysfunction of donor-funded water projects in Uyo metropolis.

## MATERIALS AND METHODS

The study adopted a combination of survey, experimental, and observational research designs. The survey design focused on gathering information through personal interviews and well-structured questionnaires; the experimental design focused on establishing cause-and-effect relationships; and the observational design focused on carefully watching, checking, and noting whatever the subject of interest is.

The research interest for the study were the donor-funded water projects in Uyo metropolis. These facilities, which are situated in different areas of Uyo metropolis, were visited and other critical factors were observed. Uyo metropolis is the capital of Akwa Ibom state in Nigeria. The population of the city stood at 436,606 people, in the 2006 census conducted by the National Population Commission (NPC) in Nigeria. According to populationstat.com, a World statistical data website, Uyo urban population is estimated at 1,393,000 and projected to be over 1.5 million by 2025. Uyo metropolis is a preferred city due to its large population. It is a destination of most developmental projects; and the political centre of the Akwa Ibom State. It is fitting due to many public water projects in the metropolis and the large number of people with access to them. Figure 1 shows the map of Uyo local government area, the study area.

Specifically, the purposive sampling technique of the non-probability sampling was adopted because different donor-funded water projects are situated in different locations which were visited and investigated on purpose. Interview sessions and questionnaire administration featured donor-funded water projects locations where caretakers were present. Observations were made in such locations. Thereafter, information obtained were summarised, edited and coded for analysis. The first, second and third objectives were answered using pictorial

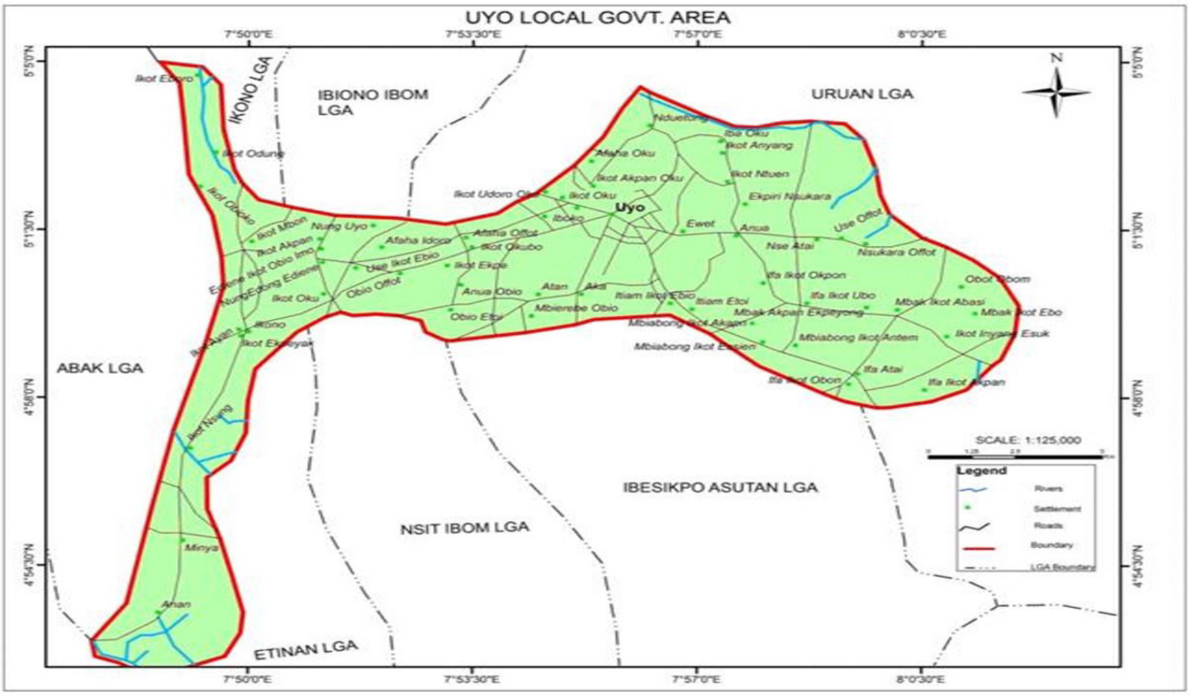


**Figure 1:** Map of the Study Area

and descriptive analyses. The respondents were presented with questions that bothered on the functionality of the water projects. The last objective was answered using the cox proportional hazard regression analysis.

### Cox Proportional Hazard Regression

Cox PH regression is used to not just estimate time-to-event for a group of individuals, but to assess the relationship of co-variables to time-to-event. Moreover, the event is the outcome of interest which may be desirable or undesirable. The Cox proportional hazard model estimates the difference in survival distributions while adjusting for covariates (Berry, 2009). The Cox proportional hazard model uses the hazard function to model survival. Hazard is the risk or probability of dysfunction of water projects in a time period having survived up to the start of that time period. In other to ascertain the risk of dysfunction, given critical factors, the Cox proportional hazard model is specified thus:

$$h(t)/h_0(t) = \exp(\beta_1 NOC + \beta_2 ACCESS + \beta_3 TMA + \beta_4 LCI) \quad (1)$$

where t is the time the water project was functional; $h(t)$ is the hazard function, $h_0(t)$ is the baseline hazard, $h(t)/h_0(t)$ is the hazard ratio that measures the effect size which is constant overtime; exp represents exponential function, $\beta_1$ represents the coefficient of the number of caretakers of respective water projects, $\beta_2$ represents the coefficient of daily average number of people that have access to the water projects, $\beta_3$ represents the coefficient of number of times the water projects underwent maintenance. $\beta_2$ represents the coefficient of level of community participation in the water projects. The measure of good fit can be tested using the Omnibus test of model coefficients; and the log likelihood statistic: the lower the log likelihood, the better the measure of fit and vice versa. The data used for the study comprised duration, continuous, and ordinal data namely, duration data that began from year of functionality to the year 2024 (year of dysfunctionality); censored data that represented water projects that are dysfunctional as at 2024 (coded 1), and water projects that got dysfunctional early enough (coded 0), continuous data for daily access to the water projects, and number of times the water projects underwent maintenance; and ordinal data for level of community participation in the water projects.

## RESULTS AND DISCUSSION

Table 1 presents the year of operations and status of the functionality of donor-funded water projects in different locations of the Uyo metropolis.

**Table 1:** Donor-Funded Water Projects, Year of Operation and Functionality

| Pipe-borne Water Projects | Donors | Year of Operation | Functionality as at the year 2024 |
|---|---|---|---|
| 1 | Uyo LG Chairman | 2008 | No |
| 2 | MDG-CGS | 2009 | No |
| 3 | MDG-CGS | 2009 | No |
| 4 | State Government | 2010 | No |

| | | | |
|---|---|---|---|
| 5 | CBUDP | 2011 | No |
| 6 | CBUDP | 2011 | No |
| 7 | CBUDP | 2011 | No |
| 8 | African Church | 2015 | No |
| 9 | Uyo LG Chairman | 2010 | No |
| 10 | MDG-CGS | 2009 | No |
| 11 | MDG-CGS | 2009 | No |
| 12 | CBUDP | 2011 | No |
| 13 | CBUDP | 2011 | No |
| 14 | State Government | 2010 | No |
| 15 | CBUDP | 2011 | No |
| 16 | CBUDP | 2011 | No |
| 17 | CBUDP | 2011 | No |
| 18 | Uyo LG Chairman | 2010 | No |
| 19 | MDG-CGS | 2009 | No |
| 20 | CBUDP | 2011 | No |

*Source: Field Work, 2024*

Table 1 shows the donor-funded water projects were dysfunctional as at the year 2024. These water projects were all functional as at the year of establishment. Table 1 shows that majority of the pipe-borne water projects were sponsored by the World Bank through its Community-Based Urban Development Programme (CBUDP); the then Chairman of Uyo Local Government Area; the Millennium Development Goals – Conditional Grant Scheme (MDG-CGS); the Saint James African Church; and the state government.

Some caretakers were present during the field work. These caretakers alleged that they were trained in various ways on how to operate the donor-funded water projects. This implication is that the training and secular education attained by these caretakers enabled them to be effective in discharging their duties. However, in the discharge of their duties as caretakers over the years, the water projects became dysfunctional. Definitely, there were probable reasons for the dysfunctionality of the donor-funded water projects. Douglas (2010) in analysing the theory of failed water aid listed lack of maintenance, irrelevant technology, lack of community participation, and lack of community development as reasons why donated water projects are dysfunctional.

**Table 2:** Caretakers' Responses to Reasons for Dysfunctionality of Donor-Funded Water Projects

| **Pipe-borne Water Projects** | **Reasons for Dysfunctionality** | | | | | |
|---|---|---|---|---|---|---|
| | **Lack of Funds** | **Lack of Maintenance** | **Irrelevant Technology** | **Lack of Community Involvement** | **Lack of Community Development** | **Vandalism** |
| 1 | - | - | - | - | - | - |
| 2 | Yes | Yes | Yes | Yes | Yes | Yes |
| 3 | - | - | - | - | - | - |
| 4 | Yes | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | - |
| 6 | Yes | Yes | Yes | Yes | Yes | Yes |
| 7 | Yes | Yes | Yes | Yes | Yes | Yes |
| 8 | Yes | Yes | Yes | Yes | Yes | Yes |
| 9 | Yes | Yes | Yes | Yes | Yes | Yes |
| 10 | Yes | Yes | Yes | Yes | Yes | Yes |
| 11 | Yes | Yes | Yes | Yes | Yes | - |
| 12 | - | - | - | - | - | - |
| 13 | - | - | - | - | - | - |
| 14 | Yes | Yes | Yes | Yes | Yes | Yes |
| 15 | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16 | Yes | Yes | Yes | Yes | Yes | Yes |
| 17 | Yes | Yes | Yes | Yes | Yes | - |
| 18 | Yes | Yes | Yes | Yes | Yes | Yes |
| 19 | Yes | Yes | Yes | Yes | Yes | - |
| 20 | Yes | Yes | Yes | Yes | Yes | Yes |

*Source: Field Work, 2024*

Table 2 reveals the reasons for the dysfunctionality of donor-funded water projects. The caretakers (except for 4 locations with no caretakers) were of the views that lack of funds, lack of maintenance, irrelevant technology, lack of community involvement and lack of community development were the reasons why the water projects are dysfunctional. Observations revealed another reason for the dysfunctionality – vandalism. Table 2 revealed that 8 of the water systems were dysfunctional because they were vandalised. These scenarios are rather unfortunate, and limit the access to water from these projects. Sadly, caretakers and households that used these facilities for their water needs now patronize private water vendors and use rain water in raining seasons.

**Figure 2:** Some Donor-Funded Water Projects in different Areas of Uyo Metropolis

In order to determine the predicted risks of dysfunction of the donor-funded water projects, given the number of caretakers, average daily number of people with access, number of times the water projects underwent maintenance, and the level of community participation in the water projects, the Cox proportional hazard regression was utilized. The Cox proportional hazard regression results are summarised in table 3.

**Table 3:** Cox Proportional Hazard Regression Results

| | Coefficient (B) | Standard Error | Wald | Degree of Freedom | P-Value (Sig.) | Hazard Ratio [Exp(B)] |
|---|---|---|---|---|---|---|
| NOC | .241 | .250 | .930 | 1 | .335 | 1.272 |
| ACCESS | .084 | .041 | 4.231 | 1 | .040 | 1.088 |
| TMA | .181 | .198 | .838 | 1 | .360 | 1.199 |
| LCI | -.073 | .049 | 1.570 | 1 | .050 | 1.093 |
| -2 Log Likelihood | | 58.919 | | | | |

*Source: SPSS 27.0*

Table 3 shows the variables in the model, the coefficient (B), the standard error (SE), the Wald statistics, the degrees of Freedom (df), the p-values (Sig.), and the hazard ratio for the covariates (EXP(B)). The log likelihood of the Cox proportional hazard regression is 58.919. The small value signifies a measure of good fit for the model.

For a continuous variable such as the number of caretakers (NOC), the positive coefficient, 0.241, and the hazard ratio of above 1.0 (1.272) implies that for every one-unit increase in the number of caretakers, the risk of dysfunction of donor-funded water projects increases at the rate of 1.272. However, the p-value of 0.335 shows that we cannot rely on the relationship. The implication is that the increase in the number of caretakers do not in any way pose a risk to the dysfunctionality of any donor-funded water projects.

For a continuous variable such as the daily average number of people that have access to respective donor-funded water projects (ACCESS), the positive coefficient, 0.084, and the hazard ratio of above 1.0 (1.088) implies that for every one-unit increase in the daily average number of people that have access to respective donor-funded water projects, the risk of dysfunction of donor-funded water projects increases at the rate of 1.088. The p-value of 0.040 shows that we can rely on the relationship. For a fact, as more people have access to water from donor-funded water projects, the more the facilities are prone to depreciate overtime. Such overlooked depreciations have increased the risk of dysfunction of the water projects in Uyo metropolis.

For a continuous variable such as the number of times the donor-funded water projects underwent maintenance (TMA), the positive coefficient, 0.181, and the hazard ratio of above 1.0 (1.199) implies that for every one-unit increase in the number of times the donor-funded water projects underwent maintenance, the risk of dysfunction of donor-funded water projects increases at the rate of 1.199. However, the p-value of 0.360 shows that we cannot rely on the relationship. The implication of this result reinforces earlier findings that depreciation due to usage over time increased the risk of dysfunction in donor-funded water projects, because they have not undergone sufficient maintenance to keep them functional by the year 2024.

For a categorical variable such as level of community involvement/participation, the negative coefficient, -0.073, and the hazard ratio of above 1.0 (1.093) implies that for every one-unit increase in the level of community involvement/participation in donor-funded water projects, the risk of dysfunction of donor-funded water projects decreases at the rate of 1.093. The p-value of 0.050 shows that we can rely on the relationship. The implication is that the efforts of the members of the communities in making sure the donor-funded water projects served its purpose may have been jeopardized by frequent criminal activities such as vandalism.

## CONCLUSION

Having examined the dysfunctionality or otherwise of donor-funded water projects in Uyo metropolis, and the risk of dysfunction given critical factors, the study discovered that all donor-funded water projects in Uyo metropolis are dysfunctional as at the end of year 2024. The study concluded that the lack of funds, lack of maintenance, irrelevant technology, lack of community involvement, lack of community development, and vandalism were factors that rendered the facilities dysfunctional. These scenarios affect the caretakers and households that once had access to the water facilities. Subsequently, the Cox proportional hazard revealed that factors such as number of caretakers, households' average daily access, maintenance times and community involvement play very important roles in the risk of dysfunction of donor-funded water projects in Uyo metropolis. Based on these findings, the following recommendations were given:

First, the dysfunctional donor-funded water systems should be resuscitated. This implies that the state government should ensure that funds are allocated to resuscitate these water facilities as they serve vital purpose in tending to the water needs of community dwellers.

Second, people in the community should be trained on how to use the technologies and secure the water projects. This will avoid any case of vandalism. Definitely these efforts will lead to the development of the communities and the State.

Third, routine and proper maintenance culture is needed to sustain the donor-funded water projects when they are eventually resuscitated. This will ensure continuous access to the water facilities.

Fourth, there is need for concerted and determined efforts by the government and other donors to establish more public water supply systems to cater for the growing number of people in Uyo metropolis.

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