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Factors Influencing Operation and Maintenance Cost Recovery in Urban Water Supply System in Southwest Nigeria

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Abstract
In Southwest, Nigeria affordability has been the prime concern of those setting water tariffs in urban water sector leading to financial unsustainability of utilities (state water corporations). The recovery of the operation and maintenance (O & M) costs are major challenges confronting most water utilities such as State Water Corporations (SWCs) in urban centres. The study is to assess the factors influencing operation and maintenance costs in six States of Southwest Nigeria. Cross sectional survey design and key informant interview guide were employed for data collection. Copies of questionnaires were administered to 1350 household respondents and SWCs officials with key informant interview guide. Data were analysed using descriptive and multiple regression analysis. The results revealed that cost recovery for the operation and maintenance costs of water supply in the six states ranged between 35% and 45% in the urban areas. 63% of the households indicated willingness to pay for water services. Water services dropped significantly below 12 hours a day in the study area, while approximately 80% of consumers have a negative perception of service delivery. The operation and maintenance costs to average cost recovery ratio was found to be 0.38 which negatively and significantly influenced water supply. The study concluded that the recovery of operation and maintenance costs of the SWCs were below the standard best practices of 75% recommended for developing countries. Therefore, the need for restructuring tariffs to meet operation and maintenance cost and better targeting for subsidies for SWCs in urban centres.

Keywords: Cost Recovery, Water Supply, Urban, Operation, Maintenance.

1. Introduction

The water management and service sectors in developing countries struggle with limited capital for investment and low cost recovery. Rationale of pricing of water considers the provision of drinking water as an economic activity, which entails cost at various stages. The processes included lifting the water from the source, treatment of water where possible and finally, transmitting to the distributing tank. All the three stages involve costs of various inputs. Pricing of water becomes imminent if the costs are to be recovered from users.

Poor operation and maintenance (O&M) cost recovery is one of the major challenges in the process of sustainable water supply provision. A sustainable water supply system is one that will meet the present requirement of adequate quantity of water with desirable quality for a given need without compromising the future ability to provide this capacity and quality. Water supply will be sustainable only if it promotes efficiencies in both demand and supply sides. On the demand side, the adoption of efficient technology and willingness to save water reduces water consumption. On the supply side, it is fundamental to enhance O&M capabilities of water utilities, reduce non-revenue water (NRW), leakages, energy use, as well as improve the capacity of the workforce to understand and operate the system. It is also necessary to ensure cost recovery through a fair tariff system and intelligent investment planning (Mohanty & Rout, 2020). The capital cost of water utilities is usually financed by the government. In the mean situation, the cost recovery refers to coverage of O&M cost (Dalhuisen et al., 2002; Gupta, 2011). Cost recovery is an essential part of sustainable water supply.

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Water supply sustainability requires at least the full recovery of O&M cost from user charges. Continuous O&M of the infrastructure is an essential part of uninterrupted water supply provision. Operation involves activities necessary to deliver the service while maintenance involves activities that keep the system in good operating condition. Operation includes monitoring the system state, running the system, and enforcing policies and procedures. Maintenance entails condition assessment, servicing repair, and replacement of the system components. The cost on O & M is an essential part to provide long-term service at a minimum cost (Zyl, 2014; Mohanty & Rout, 2020). The development of a system that enables continuous water supply and limits water supply intermittently remains a challenge. Poor governance is one of the causes of supply intermit tency (Simukonda et al., 2018). The study conducted by Zhao and Crosbie (2012) on capita water consumption from Ireland shows that the water policies and management strategy consider water as free good and renewable resource. Despite their small population, there is deliberate rise in per capita water consumption and there is no encouragement to conserve water in any way. The funds are insufficient to cover the full cost of domestic and waste water services (Zhao & Crosbie, 2012). Absence of water meters and water pricing in Kolkata indicates that water supply is almost free and leads to huge wastage of water (Majumdar & Gupta, 2017). The cost on O&M can be recovered through an appropriate tariff mechanism, investment plan, and upgrading service level by fixing a benchmark to it. Most of the countries have adopted service-level benchmarking in order to improve their water supply service to attain consumer satisfaction and cost recovery.

In this context, the available theories and approaches merit discussion. As against the accounting approach, which does not guide resource allocation, pricing based on marginal cost is theoretically agreeable for efficiency in resource allocation. Generally, prices are based upon how a consumer values a product against its costs. Both consumer's valuation costs would vary and resources get diverted to most valued users. The policy prescription equates price with marginal cost to achieve ideal output and consumption as well. The basis of pricing rests on consumer's valuation of a commodity in relation to costs. Price has a direct relationship with changing values and costs. The change in value and costs act as checks and balance the production and consumption pattern. Price sends two signals, one in discouraging consumers from an excess consumption and secondly, restricting the production to a required level.

The foregoing description, albeit brief, helps to conceptualize the problem in proper perspective. Allocation of water resources across the competing sectors is crucial. The socio-economic aspects need to be discussed in the environmental background of water resource in order to achieve sustainability. Institutional approach to water resource management calls for pricing the water supply to achieve optimal allocation and check wastage of resources

2. Conceptual Framework

Water is the essential resource for life. It is also a scarce resource both in quantity and quality, and when available it is often of poor quality depending on location. Lack of potable water and basic sanitation services remains one of the world's most urgent health issues. According to UNICEF, FAO (2016), WHO (2019), SIDA (2018), and Berbel and Exposito (2020), about 1.1 billion individuals residing in developing nations lack access to potable water, while approximately 2.6 billion people do not have access to fundamental sanitation facilities. Water resource management serves as a comprehensive framework for making decisions related to water use and conservation. It encompasses economic, environmental, and institutional considerations, reflecting the interconnectedness between water resources and human activities within the context of socio-economic development processes.

In a broader sense, water resource management as a concept may outline a framework for numerous water related decisions. Given the fact that socio-economic development processes relate to the water resource, owing to interact with water and human activities, it is imperative to conceptualize the problem in hand with respect to economic, environmental and institutional aspects.

2.1 Economic Aspects

Recognizing the critical importance of water, the United Nations Water Conference underscored that access to safe water is essential for a healthy and productive life. Unsafe water not only spreads diseases but also diminishes the time and energy of those who fetch it. Due to malnutrition, waterborne diseases take a heavy toll in developing nations. For example, in Ethiopia and several Middle Eastern countries, half of the children born do not reach the age of five due to the compounded effects of disease and malnutrition, a stark contrast to the mere two percent in the United Kingdom (Lopez-Ruiz *et al*., 2020). The conference underscored that the lack of safe water disproportionately impacts the most impoverished communities. Over time, the understanding and management of water have evolved from considering it a public good to recognizing it as an economic resource. The United Nations (1997) and the Global Water Conference at the Earth Summit in Rio de Janeiro (Agenda 21) endorsed the concept of treating water as an economic good. This paradigm shift requires fundamental changes in planning, design, pricing, and policy frameworks. Pricing policies are now designed to reflect the scarcity of water resources and ensure efficient allocation by extracting economic rents from users. Additionally, involving communities in decision-making processes at all levels is crucial for sustainable water management.

2.2 Environmental Aspects

The economic analysis of environmental resources must be grounded in a thorough understanding of the ecosystem's functions and its vital role in supporting life. According to Adams (2018), ecosystems provide essential services such as water, food from plants and animals, and other renewable resources. They also perform critical functions such as nutrient recycling, flood control, pollution filtration, waste assimilation, crop pollination, soil preservation and generation, regulation of the hydrological cycle, and maintenance of atmospheric gas composition. Adams (2018) underscores the dynamic and intricate interaction between the environmental resource base and the physical and chemical environment, which often involves non-linear relationships. Economists are urged to acknowledge these complexities when constructing models of natural systems, as they significantly influence economic decisions and policy frameworks.

This relationship between environmental degradation and population growth provides a compelling rationale for further investigation. For example, examining how family size in rural areas influences water scarcity and the distance individuals must travel to access safe water could yield valuable insights. Government interventions frequently involve establishing pricing mechanisms, such as charging per cubic meter of water consumed, aimed at regulating excessive water use. While these pricing strategies can curb water consumption, Adams (2018) contends that consumer payments may not accurately reflect the true social costs linked to water consumption. Often, government-set prices may be lower than necessary to incentivize households to use water at levels that align with social and environmental optimal standards.

2.3 Institutional Aspects

Institutions are defined as rules, norms and conventions in an economy which facilitate or hinder human activity (North 1990). Davis and North (1970) make a distinction between institutional environment and institutional arrangement. The former is the social, political and legal ground rules that govern economic activity, while the latter is an arrangement between economic units, which govern the interaction between the units. Bromley (1989) defines institutional arrangements as the rules and laws that define the operation of organizations. But, there has been enduring debate in the institutional economics literature regarding the difference between institutions and organizations. According to North (1990), organizations are groups of individuals bound by some common purpose in order to achieve certain objectives. He has considered organizations as the players of an institution. The implementation of the rules and norms can be accomplished only through organizations (Bromley 1989). In other words, Bromley argues that the existence and operation of organizations depend upon a set of institutions.

The institutional arrangement to provide water is a matter of concern in this realm. Whether water is provided free of cost to all households, can water be treated a free good any longer, are some of the questions which merit attention. Given the fact that access to safe water is a basic human right, concerted efforts have been made at the Central, State and Local body levels right from the First Five Year Plan period in the National Water Supply and Sanitation Policy, but the problems relating to recovery of Operation and Maintenance (O & M) cost are yet to be resolved, needless to say about the recovery of capital cost. Many a change can be brought in the existing institutional mechanism to overcome the problem. One possible way is through correcting and getting the prices right. A tariff, which ensures sustainable water supply, needs to be evolved.

3. Literature Review

Public piped water has been the major source of drinking water in major cities in Southwest Nigeria (SWN). There was a gradual shift by households from using piped water for drinking purpose to sachet water and then more recently, bottled water. Supply gaps are causing city dwellers to depend on privately extracted ground water, bringing down local water tables. Urban poor in cities remain the single-most affected segment by lack of water access (Taomte et al., 2025; GOI, 2019). With the increasing pace of urban growth, the urban household demand for piped water supply is likely to increase. Urban growth, planning of the city without considering its water resources and water rights of the citizens and lack of regulation is a threat to the water resources within the same urban area (Labayo & Prefia, 2025; Water Aid India, 2018). Despite the past different water reform initiatives, and paradigm shift from infrastructure to service delivery approach, impact on cost recovery on operation and maintenance cost is of little significance.

Factors affecting cost recovery of Operation and Maintenance (O & M) cost depends on the operational efficiency and inefficiency leads to higher O & M cost. In most developing countries, under-recovery of O&M cost is a major problem with urban water service (Roszkuska et al., 2023; Bandyopadhyay, 2015; Moharty & Rout, 2020). Low tariffs, low coverage of registered connections, high levels of leakage, high rate of NRW, poor metering practices, inefficient billing and collection are major problems associated with under-recovery of O&M cost of urban water service (Tarfa & Brouwer, 2024; Gupta, 2011; Nag & Garg, 2013). The shortage of revenue can affect maintenance and lead to poor quality of water supply. Most O & M costs are spent on salaries and power bill and very less is spent on maintenance of the assets (Medina-Rivas et al., 2024; Tiwari & Gulati, 2011).

Improving energy efficiency, least cost design infrastructure, and reduction in operating and capital expenditure can recover 100% operating expenditure and 80% capital expenditure (Liu et al., 2024; Misra & Goldar, 2018). Upgrading infrastructure, imposing penalties for non-payment, and introducing other specific billing payment practices have a positive effect on cost recovery. Penalizing non-payment through

service restriction for private household connections is the method adopted for successful cost recovery. The pricing mechanism that includes fairness and penalties for those not paying in proper time has influence on internalization on externality, and provides revenue sufficiency and economic efficiency (Amit & Ramachandran, 2013). An appropriate legal provision, education, information, people feeling the need for safe water, health awareness, strong institutions, expertise, and skill, affordable service, and consumer's willingness to pay can be supportive to effective O&M. The financial sustainability of the system can be influenced by the realization of people that they should pay for the service they use (Cardoso et al., 2025). The Hai water project in Tanzania is suffering from inequality in the public tap distribution and irregularity in billing. Despite the above problems, the project has performed well as reflected by coverage of O&M costs from bill collections, which is key to the sustainability of any project. From the willingness to pay and the actual performance, the project stands a chance to perform even better by improving collection efficiency (Wang et al., 2024; Moharty & Rout, 2020).

4. Materials and methods

4.1 Study area

This study was conducted in Southwest Nigeria, encompassing Oyo, Ogun, Lagos, Ekiti, Ondo, and Osun states. These states are situated along the narrow plain of the Bight of Benin, approximately between longitudes 2°42'E and 8°2'E, and latitudes 6°22'N and 6°2'N. Southwest Nigeria experiences a tropical climate with temperatures ranging 210℃ to 340℃ and annual rainfall from 150mm to 300mm mm. The region is characterized by distinct wet and dry season associated with rainstorms that can lead to water source contamination with peaks in April and August.

The study employed mixed methods, combining preliminary in-depth interviews (IDIs) with officials from state water corporations (SWCs), zonal head waterworks, and district business officials. Following this, Cross sectional survey design using an application-based research instrument was conducted among households and businesses. Additionally, validation interviews with officials and gathering administrative data from SWCs on tariffs were conducted.

The study had a descriptive nature, focusing on socio-economic factors influencing cost recovery from households, complemented by secondary data from selected water corporations. The study area encompassed various Local Government Areas (LGAs), which were divided into clusters. Purposive sampling was employed for households (HHs). Primary data were collected through questionnaire.

To determine the appropriate sample size (n), given the population size (N) and the estimated population proportion in the selected study sites, the study employed the sample size determination method described by Nqobizwe (2015). This method takes into account the population size and the estimated population proportion to calculate the sample size required to achieve reliable and representative results.

$$n = \frac{z^2}{e^2} \cdot \frac{pqN}{(N-1) + z^2pq} \quad (1)$$

where:

n = sample size
z = the z-value corresponding to the desired degree of confidence
p = the population proportion of households of interest
q = 1 - p (the complement of p)
e = the absolute size of the error (margin of error)
N = the population size.

This formula is a standard approach for determining the sample size required to achieve a specified level of precision and confidence in statistical surveys.

For Ibadan city with population of 4,979,030:

$$n = \frac{1.65^2}{0.05^2} \times \frac{(0.5)(0.5)(4979030)}{(4979030-1) + (1.65^2)(0.5)(0.5)} = 273,$$

where, N = 4,979,030, p = 0.5 (assumed to be 0.5 as this gives the maximum sample size), q = 0.5, z = 1.65 at α = 0.1 and e = 0.05.

The sample size was also determined using the same procedure above for other selected cities. Additional 10% a total sample size of 1320 households was randomly sampled and surveyed in the study area. Twelve (12) field assistants and the researcher administered copies of the questionnaire over a period of 3 months.

4.2 Data Analysis

The data were statistically analysed using tables, chart, mean score, simple percentage and multiple regression

5. Results and Discussion

The operational and maintenance costs of urban water supply systems are directly tied to the functionality of technical components. These costs encompass wages for operators and caretakers, fees for external specialists (e.g., filter maintenance), expenses for water quality testing, materials for minor repairs, and procurement costs. The Average Operation and Maintenance Cost (AOMC) refers to the annual cost of maintaining and operating one cubic meter of water. Achieving full cost recovery is crucial for ensuring efficient and sustainable urban water services, but current cost levels are insufficient to cover operational and maintenance expenses, as indicated by this study. Independent variables such as metering level, perception of water price, inadequate funding, water connections, frequency of water supply, revenue billing and willingness to pay and ability to pay are considered and discussed among the factors affecting O and M costs with negative impact on CR.

Table 1: Sampling Plan and Survey Data

City	Population (N)	Calculated Sample size (n)	No. Distributed	Properly no filled and returned
Ibadan	4,979,030	273	220	205
Abeokuta	828,323	273	220	202
Akure	587,047	273	220	200
Ado Ekiti	597,326	273	220	199
Ikeja	437,601	273	220	200
Oshogbo	299,152	273	220	200
Total		1,638	1320	1205

Table 2: Responses on how the customers perceived water price

STATE	High (%)	Fair (%)	Low (%)	Other (%)
OYO	6	87	7	-
ONDO	22	67	3	-
OGUN	20	76	4	-
OSUN	12	81	4	3
EKITI	10	81	7	2
LAGOS	30	70	-	-
Average	**16.7**	**77.0**	**4 .2**	**0.8**

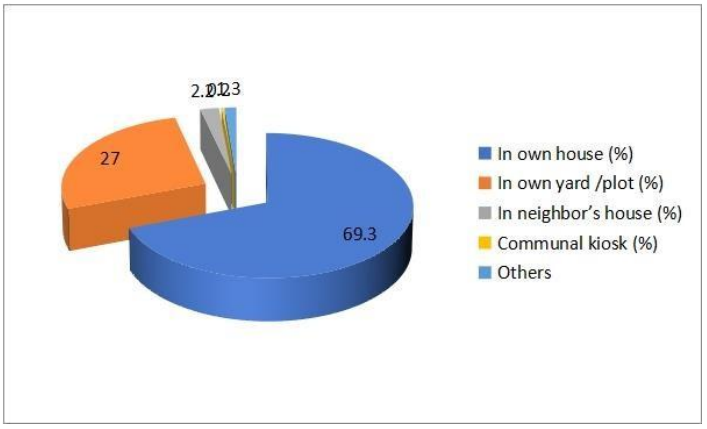

Figure 1: Building characteristics of where the source is connected.

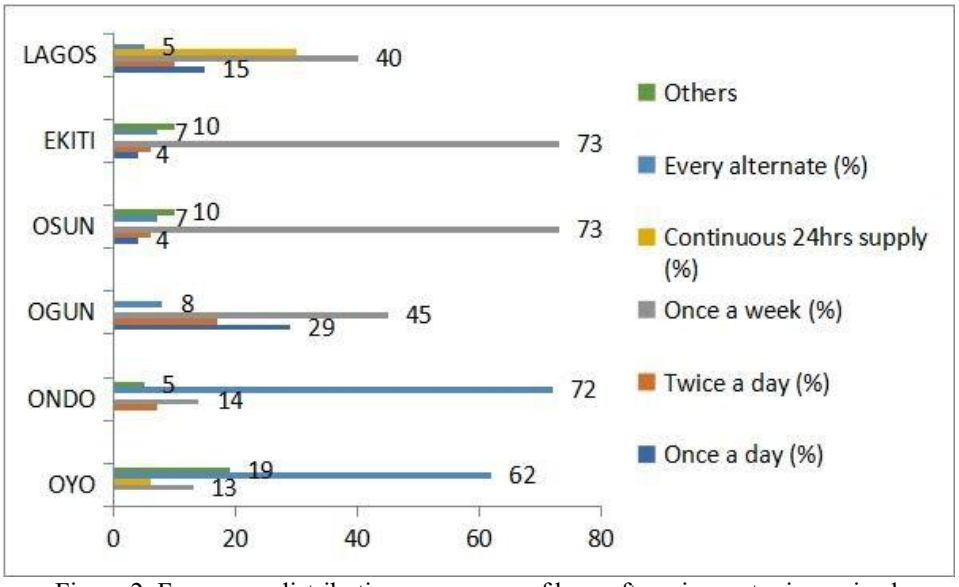

Figure 2: Frequency distribution on average of how often pipe water is received

5.1 Customers' perception of water price

Table 2 illustrates that customers perceive water prices as too low to generate sufficient revenue, largely due to low consumption caused by unreliable electricity supply to state water corporations, impacting their ability to meet water demand in the study areas. State water corporations lack awareness of their own operation and maintenance (O&M) costs and are only required to submit annual reports detailing input and associated costs. Despite 77% of respondents finding the water price fair, this perception significantly affects O&M costs. Therefore, achieving cost recovery in the study areas is challenging due to inadequate revenue from water consumption, resulting from substandard water supply service quality.

Water connections: The building characteristics as revealed in Figure 1 show that in own house connection had 69.3% while the source connected to own yard/plot had 28%, while others accounted for 3.7%. This is expected in housing development for urban dwellers which in turn makes billing less cumbersome for water providers in order to recover O and M costs of water services in the study areas in in six states of SW Nigeria.

Figure 3 indicates that 43% of respondents receive water once a week, which is deemed acceptable given the irregular water supply issues faced by Water Corporations in Southwest Nigeria. However, the main concern lies in the unequal distribution of water within municipalities. According to the survey, some areas experience infrequent water supply, with 26.8% receiving water every alternate day from the Water Corporation, while urban centers benefit from more frequent supply, likely due to their lower elevation compared to highland areas like Ekiti, Ondo, and Ogun states. Certain parts of Lagos (30%) and Oyo (6%) enjoy continuous 24-hour water supply, attributed to their proximity to waterworks and minimal unaccounted water losses.

Across the six states in Southwest Nigeria studied, Figure 3 shows that daily water supply frequencies are as follows: once a day (8.6%), twice a day (7.7%), once a week (40%), continuous 24-hour supply (6%), and other frequencies (7.3%). Continuity of supply is defined by average hours of service per day. Respondents generally expressed dissatisfaction with the water delivery system in cities across the selected states, primarily due to numerous and frequent burst pipes that are perceived as inadequately addressed, thereby disrupting supply continuity. These issues significantly impact the ability of the six Water Corporations in Southwest Nigeria to recover operation and maintenance (O&M) costs, as confirmed by key informants and reflected in unpaid revenue from billed customers.

Piped water metering: This independent variable defines the critical level of cost recovery by setting an appropriate water price that can sufficiently cover operation and maintenance (O&M) costs in urban water supply systems.

Table 3 presents findings from a household survey on piped water metering in the six cities within Southwest Nigeria's study areas. Only a small fraction of respondents (15.2%) reported having metered piped water across the six states in the region. For this minority, tariffs only reach the cost recovery range when they consume 5 cubic meters per month. In contrast, the majority of respondents (84.8%) have unmetered water, which falls significantly short of cost recovery goals. With an average fixed charge or flat rate of ₦1500.00 per month, unmetered customers only contribute enough to cover operation and maintenance (O&M) costs for 2 cubic meters per month. In reality, most unmetered households likely consume closer to 10 cubic meters per month, rendering water use charges insufficient to cover O&M costs.

Official meter coverage potentially exaggerates the true extent of metering. Studies indicate meters are often non-functional due to equipment of low quality, intermittent water supply, or deliberate tampering by households to avoid variable charges (Ncube, 2011; JMP, 2017). According to figure 3, less than 35% of water sold is metered across all six states in Southwest Nigeria. This figure exceeds the 20% reported by the World Bank in 2015, highlighting a scarcity of reliable commercial systems with monitored meter readings in the Southwest's urban water supply systems to achieve adequate O&M cost recovery.

Water price per cubic metre: Figure 4 depicts responses on the water price per cubic meter paid by respondents in Southwest Nigeria. A significant proportion of respondents (90.2%) reported paying ₦200.00 per cubic meter, with many perceiving this amount as unfair due to intermittent water supply. Those paying between ₦200 and ₦300 accounted for 9.8%. This figure represents the highest recorded per cubic meter price among the six states studied, yet it falls short of what well-managed utilities report, as noted by IBNET (2013).

Water corporations indicated they lack authority to set tariffs and rarely review them, with state governments typically setting rates. This static approach hinders achieving cost recovery until water is recognized as an economic good, billed accordingly, and customers receive regular bills (Li *et al*., 2024). A substantial percentage of customers, including commercial and industrial users, pay on a monthly basis. Residential rates range from ₦1250 to ₦1950, while industrial rates, such as for block industries, range from ₦2250 to ₦3500, as confirmed by key informants from the water corporations.

Considering current income levels, tariffs exceeding ₦200 per cubic meter would render the service unaffordable for a significant portion of the population. However, bridging the gap between affordable and cost recovery tariffs—estimated at ₦400 per cubic meter under inefficient O&M management—could potentially be achieved through improved utility

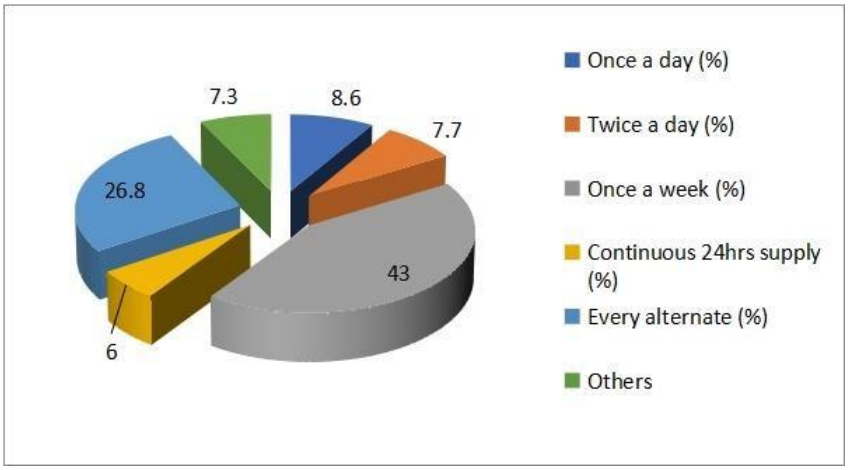

Figure 3: Average responses on regularity of piped water supply

Table 3: Responses on availability of piped water metering

STATE	Yes (%)	No (%)
OYO	22	78
ONDO	10	90
OGUN	20	80
OSUN	7	88
EKITI	7	88
LAGOS	25	75
Average	**15.16**	**84.84**

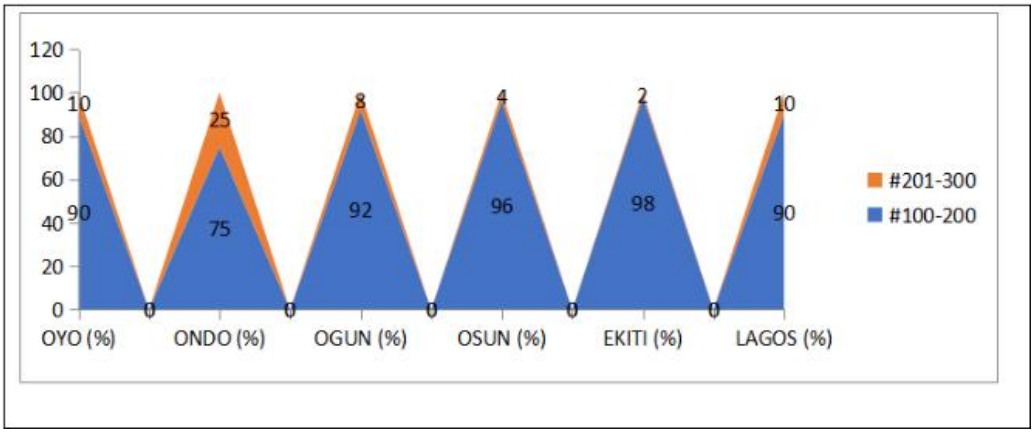

Figure 4: Responses on water price per cubic meter paid by respondents

Table 5: Responses on affordability of payment for water services

STATE	Yes (%)	No (%)
OYO	78	22
ONDO	82	18
OGUN	84	16
OSUN	86	14
EKITI	76	24
LAGOS	85	15
Average (%)	**81.8**	**18.2**

performance. This approach, as suggested by De Stefano *et al*. (2019), could involve raising tariffs closer to O&M costs while implementing targeted mechanisms to enhance performance and cost recovery without excessively burdening affordability concerns.

According to the survey results, 19.2% of respondents within the selected areas in Southwest Nigeria reported being unable to afford their water bills in the past 12 months, while 80.8% did not face such difficulties across the six states. The study indicates significant potential for unexploited O & M cost recovery (Chen & Liu, 2025), considering that 82% of respondents are able to afford water services, with a substantial number formally employed, as detailed in Table 5.

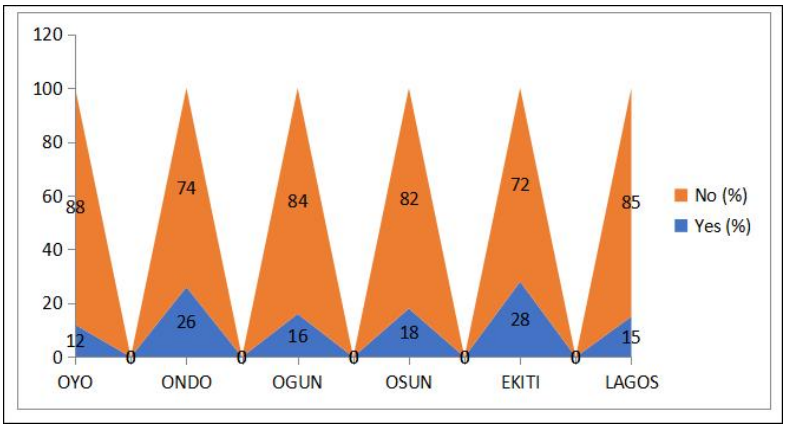

Figure 5: Customers' experience on situations where customers cannot afford to pay bills in a year.

Table 6: Regression Results on O & M costs

Dependent variable: Operation and maintenance cost		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	(Constant)	-3.664	1.534		-2.389	.018
	Perception of water price	.236	.143	.131	1.652	.100
	Inadequate Funding	2.023	.429	.295	4.715	.000
	Water connections	1.305	.332	.311	3.927	.000
	Water supply	.469	.534	.055	.878	.381
	Revenue Billing	-.180	.130	-.085	-1.386	.167
Diagnostic Tests						
F-statistic= 8.481 Probability: 0.000		**R-square: 0.159**		**Adjusted R square: 0.140**		

Hypothesis: There are no significant factors influencing the operations and maintenance costs of urban water supply systems.

The hypothesis in this study examines whether there are significant factors affecting the operations and maintenance costs of urban water supply systems. The results presented in Table 6 indicate that perception of water price, inadequate funding, water connections, and water supply have a positive relationship with the operations and maintenance costs of urban water supply systems in Southwest Nigeria. This implies that increases in perception of water price, inadequate funding, water connections, and water supply lead to higher operations and maintenance costs. Conversely, revenue billing shows a negative relationship with these costs, suggesting that higher rates of revenue billing led to lower operations and maintenance costs in Southwest Nigeria.

In terms of the estimated parameters, the study finds that a unit increase in perception of water price, inadequate funding, water connections, and water supply results in increases of 0.236, 2.032, 1.305, and 0.469 units respectively in the operations and maintenance costs of urban water supply systems. Conversely, a unit increase in revenue billing leads to a decrease of 0.180 units in these costs. The Adjusted R-square of the model is approximately 14%, indicating that variations in the operations and maintenance costs of urban water supply systems in Southwest Nigeria can be explained by changes in perception of water price, inadequate funding, water connections, water supply, and revenue billing. The remaining 86% of the variations are attributed to other factors not included in this model.

At the 0.10 level of significance, the F-statistic is 8.481 with a p-value of 0.000, which is less than the 0.10 significance level adopted for this study. Therefore, the study rejects the null hypothesis that there are no significant factors affecting the operations and maintenance costs of urban water supply systems in Southwest Nigeria. Instead, it accepts the alternative hypothesis that there are indeed significant factors influencing these costs in South West Nigeria.

The findings of this study revealed that a significant positive correlation was observed among the variables of the study, including perception of water price, inadequate funding, water connections, and water supply with operations and maintenance cost of urban water supply systems in Southwest Nigeria. Households' survey showed that the following were identified as the factors affecting operation and maintenance costs across the six states viz –a viz, staffing level (inadequate skilled labour), staff capacity building, mobility, high cost of power (diesel) and provision of stable power (electricity supply), availability of materials (chemicals) and political interferences. These factors influence negatively the operations and maintenance cost recovery systems of WCs which corroborates the findings of Adedotun *et al*. 2024 in differential urban neighbourhood water supply system.

6. Conclusion

The operations and maintenance cost recovery levels observed in the six cities analyzed in this study fell short of the standard best practices recommended for developing countries. None of the six (6) WCs met theirrevenue potential, and most of them fail to cover their operational costs by up to 75 percent. The level recorded by various WCs significantly related to the challenges facing the operation and maintenance of the WCs. The most affected challenges affecting the WC mentioned by the key informants are pipe leakages and bursts of the networks due to urban renewals projects within the study area, followed by seasonal water flow of the raw water sources which affect the water production, then lack of government support and political will.

7. Recommendations

There is need to increase the staffing level through the provision of skilled labour and capacity building in order to produce good quality water at an affordable cost so that the users are satisfied with the water supply service. Provision of stable electricity supply should be provided so that there is continuous supply of water in order to recover O & M costs. Restructuring tariffs to meet operation and maintenance cost and better targeting for subsidies should be implemented for SWCs in urban centres.

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