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Performance Enhancement of Water Supply Distribution in Ogbomoso Metropolis

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Abstract: ***The study assesses the performance, effectiveness and efficiency of the entire water supply distribution schemes in Ogbomoso North and South. The specific objectives are to assess the existing water supply distribution in Ogbomoso Township, also to carry out diagnostic assessment of the entire water distribution network, so as to evaluate the problems in the entire network. Data were collected through personal interview and observation both for the water corporation and the community supplied. A total of 200 structure questionnaires were administered to the supplied community, it was further analyzed using descriptive statistics. The study revealed that (50.5%) of the community still depended on well and borehole despite being supplied water from the scheme most especially community far away from the water scheme. Also it was gathered that there wasn't any functional booster station. In addition, feedback from the SPEM showed that the water cooperation has a (44%) operational capacity and (30%) human capacity which is below average, though the SERA showed there were well defined policies and procedures while other evaluation such as organization structure, inventory control and equipment management, work order system are below average. The result shows that the Water supply distribution scheme could not meet the demand of the population in the area. The study therefore recommends the water board should look into alternative source of power which has being the main source of inconsistency in water supply, proper monitoring of the whole board for credibility and accountability and Proper funding of staff to encourage young learned personnel have interest in working in the water board.***

Keywords: Performance Enhancement, Water Supply, Well, Borehole and Operational Capacity

1. Introduction

A water supply system collects, treats, stores, and distributes water among water users and consumers Increasing population, diminishing supplies and variable climatic conditions have resulted in difficulties in meeting water demands; especially in arid and semiarid regions where water resources are limited. Given the system complexity and the interactions among users and suppliers, a large-scale water supply management model can be useful for decision makers to plan water management strategies (May, 2014, Muhammad, 2014 & Adewumi, 2018).

A water distribution network is a system containing pipes, reservoirs, pumps, and valves of different types, which are connected to each other to provide water to consumers. In the case of the design of a pipe network the optimization scenario intends to minimize the cost of the network components subject to the satisfactory performance of the water distribution system (mainly, the satisfaction of the allowable pressures(EPA, 2007 & Estes and Frangpol, 2005).

However, optimal control system in water supply system consists of defining the pump scheduling over a predefined time period so that the demand for water and hydraulic network conditions are met, and the total cost of the electricity consumed is minimized (Adewumi, 2018 & Feldman, 2009).

1) A hydraulic network model, which ensures that the hydraulic operating conditions of the network are met.
2) A demand-forecasting model that provides an estimate of the water consumption patterns in reservoirs over the periods of the planning horizon.
3) An optimal control model of the system where the decisions regarding the operating policies of the system that minimize a certain cost are determined.

In Ogbomoso, despite the fact that the system was properly designed and constructed, some of the facilities are functional but working below the installed capacity. The people of Ogbomoso have come to rely heavily on water vendors, hand dug wells, boreholes and rainwater harvesting which may not necessarily be safe. The consumption of water from these doubtful sources have been proven too often to results in the spread of water borne and water based diseases such as diarrhoea, cholera, typhoid fever, paratyphoid fever, hepatitis, ameobiasis among others.

The aim of this study is to assess the performance of water supply distribution in Ogbomoso and to enhance the effectiveness.
The specific objectives are to:

1) Assess the existing water supply distribution in Ogbomoso township;
2) Carry out diagnostic assessment of the entire water distribution network, so as to evaluate the problems in the entire network.

While distribution systems may affect drinking water quality and water quality may affect health, this research does not address these possible effects. This research is limited to the physical integrity of the components of the distribution system and the consistent availability of water to its citizenry.

Amit and Ramachandran (2009) stated that the main purpose of water distribution network is to provide customers with a reliable supply of good quality water with specific pressure levels under various demand condition. For this purpose,

water distribution networks are made of several components such as pipes, reservoirs, pumps, valves, and other hydraulic components. Salman (2011) stated that a pipeline is divided into several segments, which are located between two or more isolation valves.

The purpose of the isolation valves is to isolate a segment from the entire network during maintenance. Walski (2002) proposed a method for identifying the segments that are formed after the installation and closure of isolation valves in a water distribution network . Giutolisi and Savic (2010) adopted Walsks's (1993a &b) definition for segments as a portion of a network made of one or more pipes and nodes. Thus, the water distribution network is considered herein to be made of pipelines and accessories.

2. Methodology

Brief Description of the Study Area

Ogbomoso North Local Government Area came into existence on September 24, 1991, as a result of the splitting of the former Ogbomoso metropolis into two. Ogbomoso North Local Government Area is bounded in the North and the East by Surulere Local Government Area, in the South by Ogbomoso South Local Government Area and in the West by Orire Local Government Area. Ogbomoso North has its headquarters located at Kinnira. The major occupations of the population are farming, trading, teaching and artisans. The local government council is constituted by Ten (10) wards and they are: Masifa/ Aguodo, Sabo/ Taara, Isale- Afon, Okelerin, Osupa, Aaje/ Ogunbado, Jagun, Ita-Alasa, Isale-Ora/ Saja and Abogunde. Ogbomoso south LGA occupies an area land mass of about 30 square kilometres and is bounded in the north by Ogbomoso North Local Government, in the south by OgoOluwa Local Government, in the east by Surulere Local Government and in the west by Orire Local Government (Ibironke *et al*., 2016).

Ogbomoso South has its headquarters located at Sunsun /Arowomole, Ogbomoso. It's being in the savannah zone makes farming the major occupation of the people of the area. Other occupation they engage in are trading, teaching and artisans. The Ten (10) wards of the local government are: Ibapon, Ijeru I, Ijeru II, Arowomole, Akata, Alapata, Isoko, Ilogbo, Lagbedu/ Isapa and Oke-Ola/ Farm settlement.The Ogbomoso South Local Government has a population of 100,815 people and Ogbomoso North Local Government has the city's largest population with a figure of 235,710 residents (Ibironke *et al*., 2016 & Adewumi, 2018).

Method of Data collection

Data were collected through questionnaire method, filled in by enumeration. The preference for the method was due to ability to retrieve clear information, unbiased data, detailed information, on-the-site data assessment and the ease of data analysis. Two sets of questionnaires were designed: one for the consumers and the other for the waterworks district officer. In order to assess the condition of the water distribution system, an inventory was carried out by onsite, physical and visual inspection of all the elements in the distribution system. The equipment and facilities were assessed during operation. The onsite inspection was carried out with the operations staff of the facilities to provide information and documentation as needed.

Qualitative assessment of equipment/facilities physical condition and functionality were also conducted. The physical condition relates to the appearance, including apparent wear and corrosion as well as operating characteristics such as noise, vibration and temperature. Functionality relates to the ability of the piece of equipment to accomplish its purpose. Both physical condition and functionality were given a numeric rating from 0 – 4.

Survey Coverage

The survey was limited to Ogbomoso North and Ogbomoso South Local Government Area. The situational analysis of the distribution network was also carried out using performance indicators, which were measured using key indicators. A Service Performance Evaluation Metrics (SPEM), was use to estimate the condition of the existing network through level of service delivery. It is a preliminary approach to get a rational benchmark tool for evaluating local Water Supply Scheme (WSS). The key performance areas evaluated by SPEM were operational, institutional and human resources capacities of the distribution system. A scoring matrix was developed for evaluating each of these performance areas using some key performance indicators (KPIs). A rating scale of 1-5 was used, with Excellent =5, Very Good =4, Good=3, Fair =2, Poor =1.

Operational Capacity Utilizations

The information gathered during the onsite, physical and visual and physical inspection together with consultation and interactions were used in the operational evaluation using Sustainable and Effectiveness Approach (SERA)

Sustainable and Effectiveness Ranking Approach (SERA)

This assesses the management, resources allocations, operation efficiency and technological indicators of a scheme with a view to providing a sound technical basis for auditing the organizations work. The following operational indicators were considered: policies and procedures, organizational structure, role and responsibility, inventories control and equipment management and work order system. A five point (5) rating scoring was used with 1 being poor and 5 being excellent.

3. Results and Discussion

Frequency of water supplied

The frequency of water supplied in the metropolis is shown in Table 1, Water supply in Ogbomoso was twice in a week, once or twice a month for various area. It was also discovered that only areas close to the water source (reservoir) got water frequently. Eighty five (85)% of the respondent complained of period of water shortage. Factors responsible for shortage by water corporation includes; faulty pipe system (36.3%), faulty pumping machine (20.9%),intentional breakage in supply by water works due to services of the distribution system (8.8%) and others (34.1%). The others includes; topography and power supply among others

Table 1: Frequency of getting water

Getting water from Water Corporation	Frequency	Percentage (%)
Yes	107	53.5
No	93	46.5
Total	200	100
Frequency of Water supply		
Daily	10	9.3
Three times a week	22	20.6
Twice weekly	39	36.4
Monthly	35	32.7
Anytime	1	0.9
Total	107	100
How long the water last(hrs)		
Less than 2hrs	43	40.2
4hrs	20	18.7
6hrs	15	14.0
More than 6hrs	26	24.3
Anytime	3	2.8
Total	107	100
Daily Water Supply		
Morning (5am-12 noon)	26	24.3
Afternoon(12noon-6pm)	20	18.7
Night(7pm-5am)	0.8	7.5
Anytime	53	49.5
Total	107	100

On the assessment of Water Corporation rating, both in terms of cost and the overall rating of the corporation by the consumer, 52.3% of the respondent agreed that the fee on water was moderate and could be afforded as presented in Table 2. In further finding through direct interview it was discovered that some areas uses meter which reads their consumption rate while others which couldn't afford to get one pay flat rate of #2,000 monthly. The amount seems satisfactory to most consumers though they were not contended with the quality of service.

However, larger percentage of respondent rated the water Corporation at 37%, which is below average as shown in Figure 1. Therefore, the Water Corporation must brace up to meet the increasing demand of the consumer and thereby earning their trust.

Table 2: Cost of Water Rating

Cost of water	Frequency	Percentage (%)
High	27	25.2
Moderate	56	52.3
Low	7	6.5
Can't say	17	15.9
Total	107	100
Convenience in Paying water bill		
Yes	52	48.6
No	29	27.1
Can't say	26	24.3
Total	107	100

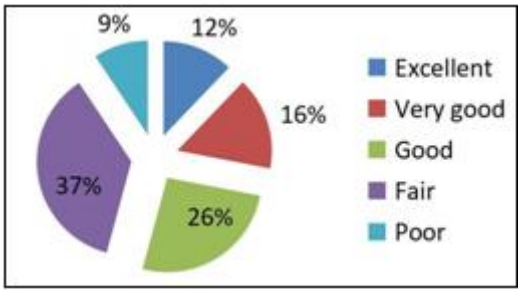

Figure 1: Water Corporation rating

Physical and Functionality Pumps Rating

Most of the pumps in the pumping station have good physical condition and functional rating. It is only pump 3 at the water scheme pump station that is in bad condition. At the time of carrying out this research, this pump was not functioning. The pump that is in bad conditions need to be repaired for the water supply system to function efficiently and optimally. The condition assessment and functionality rating of the pumps in the pumping stations is shown in Table 3.

Table 3: Pumping Station Condition Assessment

Pump station	Equipment Number	Rating									
		Physical condition					Functionality				
		0	1	2	3	4	0	1	2	3	4
Water scheme	Pump 1(HLP 1)					√				√	
	Pump 2(HLP 2)				√					√	
	Pump 3(HLP 3)			√				√			
	Pump 4(HLP 4)			√				√			
	Pump 5(LLP 1)					√				√	
	Pump 6(LLP 2)					√				√	

Performance Evaluation Analysis

Data collected during the onsite, physical and visual inspection of the entire element in the distribution system was analyzed and used as in SPEM and SERA performance analysis. The summary of outcome from performance evaluation is shown in Tables 4 –5.

Table 4: Summary of Performance Evaluation Using SPEM

Item	Operational Capacity	Human Resources Capacity	Total
Scores	11	3	14
Scores in %	44	30	40

Table 5: Summary of Performance Evaluation Using SERA

Item	Policies and Procedure	Organizational Structure	Inventory Control and Equipment Management	Work Order System	Total
Scores	36	12	8	12	68
Score in %	90	48	32	48	59

The results shown in Table 4 shows that the Water Distribution system in Ogbomoso Metropoilis has operation capacity , human resources capacity and total evaluation capacity of 44 , 30 and 40%, respectively. The score is below average which suggest that there is need to improve on training and development of staff in charge of operation and maintenance of the distribution system. Also, the result in Table 5 shows the summary of performance evaluation using SERA. This indicates that the system has good policies and procedures but poor organization structure, inventories and equipment management and work order system.

However, organizational structure and the work order system is encouraging and should be improved upon. The capabilities of human resources management of water supply system can be improved through standardized vocational training approach and continuous education on the job training. Effective training can be beneficial to the organization in many ways. It can enhance compliance with policy, specification and applicable regulatory requirements, thereby reducing liability and cost. From management perspective, it can empower the employees to make decisions and provide skilled labour. The training course should include planning and implementation, waste minimization practices, water leakage monitoring technologies and techniques concerned with handling water in environmentally sound manner, emergency repairs, data collection and analysis.

Furthermore, Water Corporation should devote at least 5% of the annual personal and overhead cost of water supply to human development. The Board should liaise with the National Water Resources Institute and other training institutions in water and sanitation to access human resources requirement for optimum performance and appropriate capacity building interventions.

4. Conclusion and Recommendations

4.1 Conclusion

A diagnostic assessment of the entire components in the Water distribution system in Ogbomoso metropolis was carried out in this study. The following conclusions are made

1) The dis-satisfaction of the consumer with Water distribution system especially those who resides at a far distance.
2) The existing system facilities have good physical condition and functionality rating
3) Performance evaluation show that the distribution system does not have enough staff for its operation and maintenance.

4.2 Recommendations from the Study

The following recommendations were made from this study

1) Log books should be provided for all the units in the distribution system for proper recording of all the activities in the distribution system.
2) District Metered Areas (DMAs) such as the two non-functioning booster stations at Osupa and Isale- general should be restored and flow entering and leaving the (DMAs) should be metered. This will enable the execution of water balance and analysis of flows to quantify the level of leakages.

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