

# OPERATION STRATEGY FOR WATER SUPPLY SERVICE DELIVERY IN LUSAKA'S UPCOMING RESIDENTIAL AREAS. A CASE OF LUSAKA WATER AND SEWERAGE COMPANY

Bweupe Lombanya<sup>1</sup> and Joseph Mwape Chileshe<sup>2</sup>

<sup>1</sup>MEng Student in Engineering Management, Department of Agricultural Engineering, University of Zambia, Email: blombanya@gmail.com

<sup>2</sup>Department of Agricultural Engineering, University of Zambia



## ABSTRACT

*Access to safe and affordable drinking water is a basic need for every human being. However, with Lusaka Province being the fastest province in Zambia, it is evident that the rapid development of upcoming residential areas as well as illegal settlements in the outskirts of the city has outpaced the installation of water supply system by the water utility company. Therefore, the main aim of this study was to assess Lusaka Water and Sewerage Company's competitive priorities in its endeavor to provide safe and affordable water services in Lusaka's upcoming residential areas. The research employed a non-intervention approach. Structured questionnaires and interviews were used for data collection. 30 household questionnaires were administered to households in Libala, Chalala and Obama residential areas respectively. Two water samples were collected randomly from each location and tested for quality. The findings showed that cost of drilling a residential borehole was K 17,351 with the reported minimum cost at K5000 and maximum at K75, 000. Borehole water from Chalala and Obama was found to be contaminated with total and faecal coliform bacteria. Nonetheless, piped water in Libala was found to be compliant with the World Health Organisation (WHO) standards. The residents in Libala were also generally satisfied with the water supply services, but had concerns over the high water tariffs, the late response to water problems and the elevated levels of chlorine in the water. Majority of the respondents also reported that a decentralized water supply system was an innovative idea. From the overall findings, the main operational core competency identified was the water quality. As a result, for LWSC to extend water supply to the upcoming residential areas in Lusaka, it was recommended that LWSC formulates a well-documented operations strategy that will focus on the cost of the service and time of service delivery. These can be achieved through a well thought out and implementable capacity strategy and asset management. Capacity strategy will involve decisions on the sizing, timing, type and location of real assets or resources.*

**Keywords:** Operations Strategy, Competency, Cost, Quality, time

## INTRODUCTION

### Operations Strategy

A lot of time and effort is invested by managements in analysing environmental capabilities and services to develop their strategy. Unfortunately, very few organisations invest the same amount of effort in implementing and reviewing their strategy and as a result 9 out of 10 businesses fail to implement their strategy successfully (Slack and Lewis, 2000). Operations Strategy is the 'How' in any corporate and market strategy.

The operations strategy concept is concerned with setting of broad policies and plans for using the resources of the firm to best support its long-term competitive strategy (Chase et al, 2006). Mieghem and Jan (2008) defines it as a plan for developing resources and configuring processes

such that resulting competencies maximize net present value. Operations Strategy answers mainly three questions; What should operations be good at? Which competencies should be nurtured? Which operational system of resources and processes best provide these competencies? Operations strategy is defined by a firm's competitive priorities, their different areas of resolutions and competitive areas of decisions. It is the 'HOW' in any business and market strategy (Krajewsky and Ritzmans 2000).

One of the critical components in operations strategy is the firm's ability to identify its core competencies that are crucial to the business strategy. By dedicating more resources are to these priority areas the firm increase its performance (Mieghem and Jan, 2008).

## Framework for formulating operations strategy

The framework for formulating operations strategy (Figure 1), based on the principle of strategic fit, helps to answer three types of questions:

1. How does the organization seek to compete and provide value to its customers? For each targeted customer segment, how is the customer value proposition prioritized around cost, time, quality and flexibility?
2. What must operations do particularly well? For each targeted customer segment, how are the operations' competencies prioritized around cost, flow time, quality, and flexibility?
3. Which resources and processes best provide that competency prioritization? For each targeted customer segment, how are the asset portfolio (sizing, timing and location of each resource type) and the activity network (supply, technology, demand and innovation management) configured?

## Water Supply situation in Zambia

Zambia is one of the countries blessed with abundant water resources. However, prior to the sector reforms of 1994, the Zambian water sector was characterized by lack of guiding policy, very low cost recovery, poor human resource both in terms of quality and quantity, decrepit infrastructure, and little or no investment for network expansion. As a result of these problems, the water distribution systems infrastructure throughout the country deteriorated to such an extent that over half of the water produced was lost before reaching the consumer. Lack of clearly defined roles and jurisdictional responsibilities led to duplication of efforts in the sector. There was no legislation to guide the provision of water and sanitation services. The management of water resources was inefficient. Overall, the water sector was disorganized and service provision undesirable. The quality of water produced soon became a health hazard (Banda,2004).



Figure 1: Framework for formulating Operation Strategies (Source: Mieghem and Jan, 2008)

The Government, through the National Water Policy (1994), committed itself to transforming the water sector to ensure the provision of quality water and sanitation services, at affordable costs and on a sustainable basis. In the policy, one of the sector principles was to devolve the supply responsibilities to local authorities and companies (National Water Policy, 1994). This was done with the view to provide efficient water supply and sanitation services within the commercial utilities' area of jurisdiction.

However, despite the various efforts by the government to improve the water supply services in Zambia, the increasing number of housing units has led to the use of alternatives water sources thereby increasing private borehole drilling operations which have a potentially harming effect on the quality of groundwater supplied to the households if done without regulation. This coupled with unplanned settlement which can result in encroachment in LWSC wells perimeters poses a big challenge for the utility company.

In early 2017, a microbiological assessment of borehole water was done in Libala south which indicated extensive use of contaminated groundwater which might lead to adverse health effect (Nakaonga et al, 2017). The LWSC has on several times registered its concerns over construction activities in unplanned settlements as they are a threat to the water table and the quality of water and sanitation in the housing projects (Times of Zambia, 2016).

### **Water Supply in Other Countries**

It has generally been observed that rapid urbanization of major cities in sub-Saharan Africa is a big issue because most of them lack the necessary infrastructure to support population growth.

According to Oluwabunmi Michael, the major challenges that Nigeria faces in the water sector include among others; poor funds management, inadequate information and education, land issues water scarcity and maintenance (Oluwabunmi, 2013). Odira explained that Kenya faced a complex water resource crisis that was as a result of the following state of affairs; an extremely limited annual renewable fresh water resource per capita growing demand of water, reduction of natural storage and lack of artificial storage capacity. The other challenges being faced were due to poor technical, financial and commercial management of Water Supply Service Utilities (Odira, 2015).

One of the countries that is seemingly succeeding in its endeavor to supply water to its burgeoning urban areas is South Africa. However, despite the successes scored, South Africa department of water affairs and the municipalities still faces a number of challenges such as sound asset management, appropriate pricing to ensure adequate maintenance, timely replacement of infrastructure, wise and effective use of public resources etc. In order to mitigate challenges, South Africa has invested in strong research and training infrastructure in the water sector (WISA, 2010). The government also involves financiers and promoters as well as the civil society (Development Bank of Southern Africa, 2005-2006). Water departments are also in partnership with Borehole Water Association so as to encourage residents to use borehole

water and thus relieve pressure on surface water. Troskie and Johnstone revealed that a well maintained borehole is a cost-effective and self sufficient asset even though the initial costs of drilling and equipping may be high ( Troskie and Johnstone, 2016)

To transform operations into a strategic weapon requires integrating all the major elements of operations into a coherent system that provides the specific capabilities needed for continuous improvement and competitive advantage. Creating the integrated system and the alignment with the broader strategic goals is the task of operations strategy (Lee and Ritzman, 2005).

This study therefore assessed LWSC's competitive priorities in its endeavor to provide safe and affordable water services in Lusaka's new residential areas.

### **Objectives**

The objectives were as follows;

1. To assess the institutional policy or framework regarding operations strategies put in place by Lusaka Water and Sewerage Company to monitor the quality of Water and Sanitation services in new residential areas.
2. To examine the challenges faced by LWSC in connecting new housing units to the existing system.
3. To investigate physical, chemical and microbiological quality of water supplied in selected residential areas of Lusaka District.
4. To analyse the feasibility and acceptability of LWSC putting up decentralised water supply system in the new residential areas.

## **METHODOLOGY**

### *Study Areas*

The study was conducted in Lusaka District, specifically; Obama (located in the eastern part of Lusaka), Libala and Chalala residential areas (In the south of the district). Obama and Chalala were chosen because they are new residential areas which depend on boreholes as sources of water as they are not yet connected to the LWSC water distribution network. Libala was chosen because it is one of the areas that are already connected to the LWSC water distribution network that are thought to be experiencing a favorable water

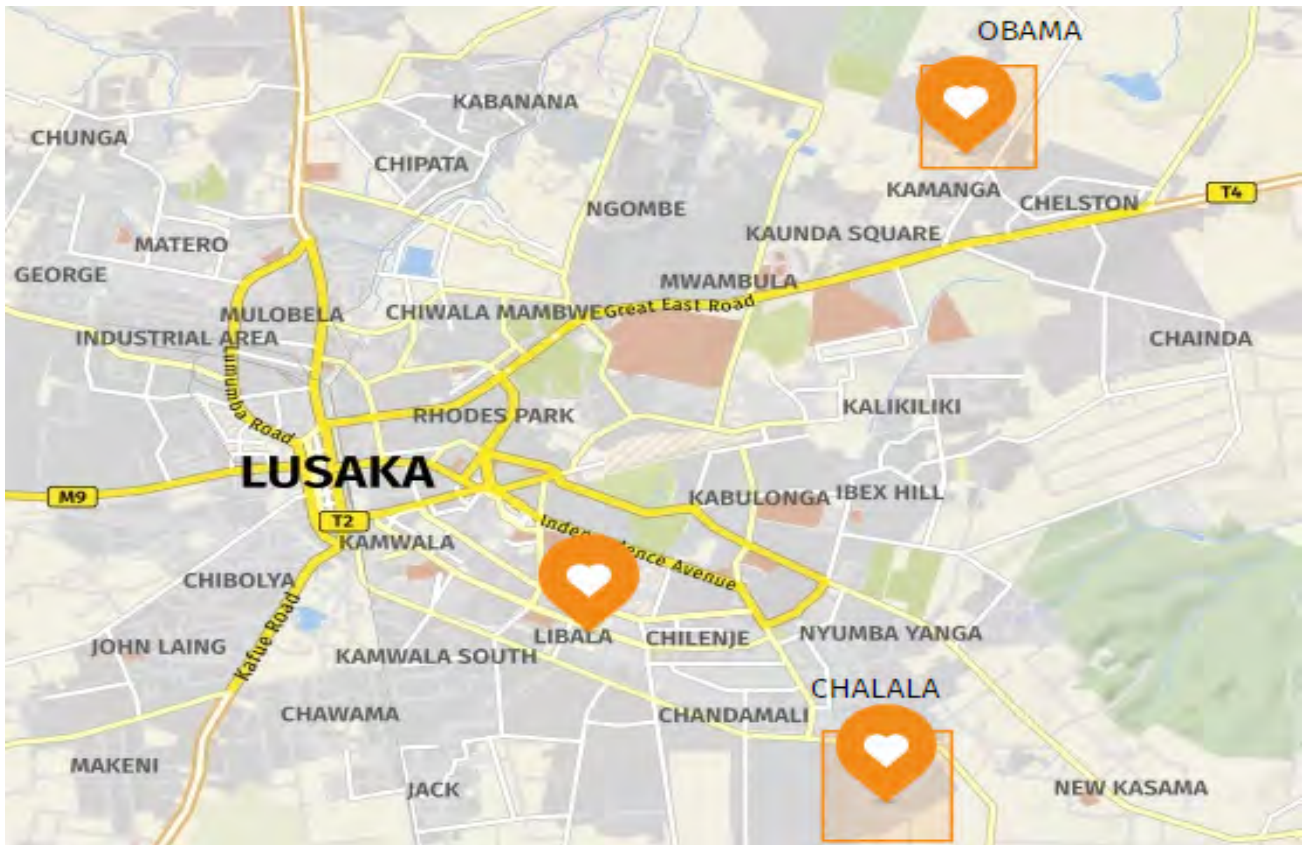


Figure 2: Map of Lusaka highlighting study sites (Source: www.mapz.com)

supply service. Figure 2 shows the map of Lusaka district that illustrates the main study sites.

#### *Sampling Procedures and Sample Size*

The population of households in the study areas was estimated to be over 3000 (CSO,2010). A sample of 30 was targeted from each area . Sample size was calculated using Equation 1 (Belle and Millard, 1998):

$$n = \frac{8(CV)^2}{(PC)^2} [1 + (1 - PC)^2] \dots\dots\dots (1)$$

Where, n= sample size, PC is proportionate change in mean, CV is coefficient of variation. PC was taken to be 20% and CV was taken to be 30 %. From these values, sample size was found to be approximately 30 (Belle and Millard, 1998). Households were sampled purposively. This means that the study targeted a group of households believed to be reliable for the study. If the chosen house failed to give response, the next house was included. This technic can be carried out in addition to probability sampling and is

particularly relevant when a study is concerned with exploring the given study population understanding the respondents. Purposive sampling can be used with both quantitative and qualitative studies (Kombo and Tromp, 2006).

Furthermore, the study also collected data through personal discussions with employees of LWSC.

In addition, two (2) water samples were collected from each of the residential areas selected to measure the water quality. Limited financial resources constrained the research to only two samples.

#### *Nature and Sources of Data*

The nature of the data was both quantitative and qualitative. The sources of data were primary and secondary.

The two instruments used for primary data collection were structured questionnaires and interviews. Observation and laboratory analyses of water samples were also used.

Secondary data involved collection and analysis of published materials, and written information from LWSC internal sources. The

main source of secondary data was the company website and publications such as water sector news articles and reports and other electronically stored information.

### Observation

The observation technique was also used as a tool for collecting primary data. Using this, the study physically obtained data by observing different issues that consumers in other residential areas had.

### Data Analysis

The collected data was analyzed both quantitatively as well as qualitatively. Data entry for quantitative data collected from primary sources was done using a statistical software package called Epi Data software and the analysis was done in microsoft excel (Epidata, 2013). Qualitative data was analysed descriptively and thematically. Water samples were analysed using water quality analysis laboratory methods.

### Summary of key data asked for in questionnaires

#### (1) Household Questionnaires

- (i) Education level of respondents
- (ii) Length of stay in current home
- (iii) Source of water
- (iv) Knowledge of borehole installation requirements
- (v) Cost of drilling and installing borehole unit
- (vi) Cost of repairing a borehole
- (vii) Distance between location of borehole and septic tank
- (viii) Water quality testing
- (ix) Occurrence of water borne diseases in households
- (x) Respondents thought of the borehole decentralisation in households
- (xi) How LWSC can improve delivery of water services
- (xii) Affordability of water supplied by LWSC
- (xiii) Cost respondents pay for water services every month.
- (xiv) Perception of LWSC water quality
- (xv) Time taken for LWSC to respond to water related problems
- (xvi) Respondents level of satisfaction with water services supplied by LWSC
- (xvii) Flexibility of LWSC water services.

#### (2) Management Interview guide

- (i) Highest level of education
- (ii) Institutional policy or framework for water quality monitoring
- (iii) Challenges LWSC faces in connecting new residential areas
- (iv) Strategies put in place to address challenges
- (v) Impact of population growth rate on organisations planning
- (vi) LWSC operational core competencies
- (vii) Number of boreholes operated by LWSC
- (viii) Knowledge about borehole decentralisation consideration
- (ix) Thoughts on the idea of LWSC putting up decentralised water supply systems in new residential areas
- (x) Resources that might be needed for the decentralisation to work
- (xi) LWSC's work with real estate stakeholders
- (xii) Room for subcontracting
- (xiii) Key competencies for purposes of decentralisation
- (xiv) Suggestions of ways of improving delivery of water services in new residential area.

## RESULTS

### Results for Households with Borehole Water

#### Cost drilling and installing borehole unit

Table 1 shows the cost of drilling and installing borehole units by households. With regards to cost of installing borehole unit, 42% of respondents reported that it cost them between K 10, 000 and K19,999 followed by 29% who reported that the cost was between K20,000 and K29,999. Only 11% reported a cost less than K 10,000. The average cost was K17, 425.

Table 1: Cost of drilling and installing borehole units

Cost of installing Borehole Unit	Percentage of boreholes
<K10,000	10.9
K10,000-K19,999	41.8
K20,000-K29,999	29.1
K30,000+	3.6
No Response	14.6
Total	100.0

There were 38% of households whose boreholes needed repairs at some point while over half of the households (60%) did not encounter a malfunction of their borehole to require repairs. All of the households whose boreholes ever needed repairs had them fixed.

Shows how much it had cost to repair the boreholes that had once broken down. 38.2% of households had repaired the boreholes before. The average cost of repairing the boreholes was K 1,819. The minimum cost was K 500 and the maximum was K3,500. Noticeably, 33% of households repaired their boreholes at K 2,000 followed by 14% who had them repaired at a cost of K 1,500.

Table 2: **Borehole ever needed repairs**

Cost of Borehole Repair (ZMK)	Percentage of Respondents Citing the Cost	Measure of Central Tendency
500	4.8	
1000	4.8	Mean = K1,819
1200	14.3	
1500	19.1	Min = K500
1800	9.5	
2000	33.3	Max = K3,500
3000	9.5	
3500	4.8	
Total	100.0	

### *Uses of water from borehole*

The uses of water from boreholes among households include; drinking, bathing, cooking, washing and gardening. All of these uses were reported by respondents. There were no other uses reported under the provision where respondents were asked to specify any other use.

### *Frequency of pumping water from borehole*

About 6 per 10 households (62%) pumped water from the boreholes often, 20% did not often pump water while 18% pumped water from their borehole very often.

### *Distance between borehole pump and soak away*

The average distance between soak away and borehole pump was 7.6 meters. The lowest reported distance was 2 meters while the maximum distance was 20 meters. Almost a quarter (24%) of the respondents reported that the soak away and borehole pump were 5 meters apart followed by 20% who reported that they were 10 meters apart. This was then followed by 13% of respondents who reported that the distance between the soak away and borehole pump was 3 meters.

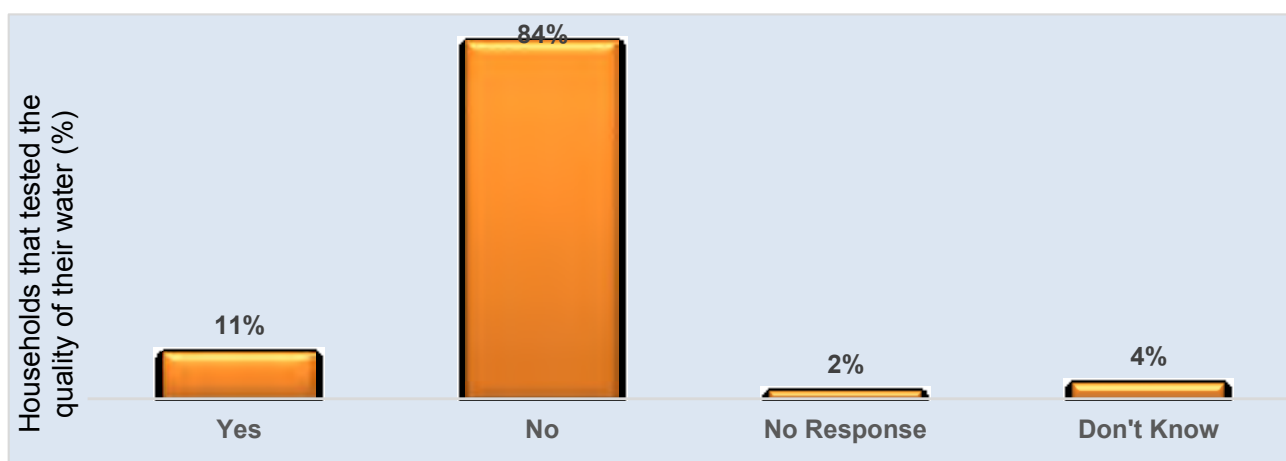


Figure 3: **Testing water for quality**

### *Testing water for quality*

Figure... shows the number of households who had taken a step to test their borehole water for quality. A majority 84% of households had never tested their water for quality. Only 11% of the

households reported that they had tested their water for quality. Out of the 6 households whose water was tested for quality, 4 (67%) conducted the test at home while 2 (33%) carried out the test at a lab.

### ***Anyone ever suffered from diseases suspected to be waterborne***

87% of the households reported that no one had ever suffered from a disease suspected to be waterborne. However, only 5% reported that there was an occurrence of diseases suspected to be waterborne. This disease in particular was diarrhea.

### **Results for Households with piped water**

### ***Monthly cost of LWSC water***

Figure 5 shows how much respondents spent on LWSC water per month. Most of the respondents (34%) reported that they paid between K100 and K199 kwacha per month for water bills, followed

by 29% who reported that they paid between K200 and K299. 17% paid between K300 and K399 while 9% paid K500 and above. Those

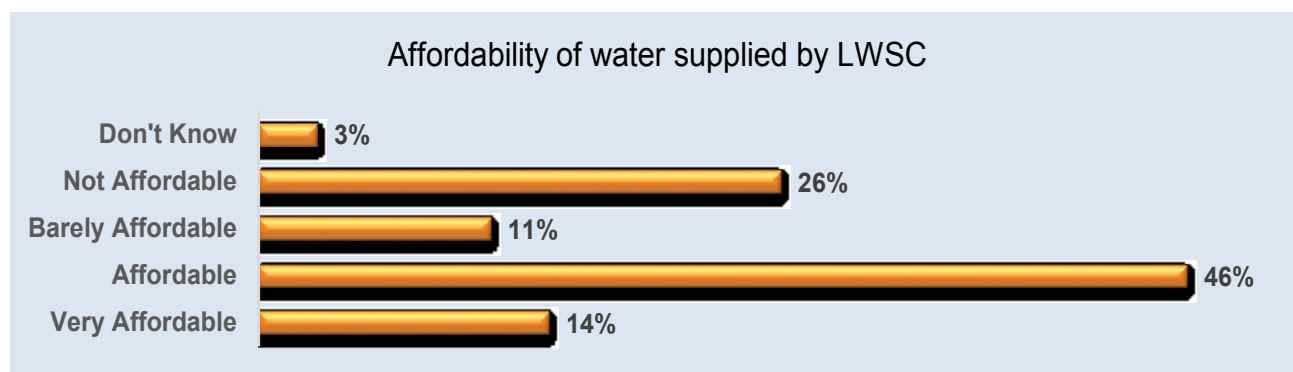


Figure 4: Affordability of water supplied by LWSC

### ***Affordability of water supplied by LWSC***

Figure 4 shows the affordability of water supplied by LWSC. Nearly half 46%, of respondents from households with piped water reported that the water supplied by LWSC was affordable and 14% reported that it was very affordable. Slightly above a quarter (26%) mentioned that the water was not affordable while 11% reported that it was barely affordable.

who paid less than K100 and between K400 and K499 each accounted for 6% of the respondents.

### ***Respondents' perception on quality of water***

Respondents were asked whether they thought water supplied by LWSC was of good quality and almost three quarters (71%) reported that they thought it was of good quality. The remaining 29% reported that they thought the water was not of good quality.

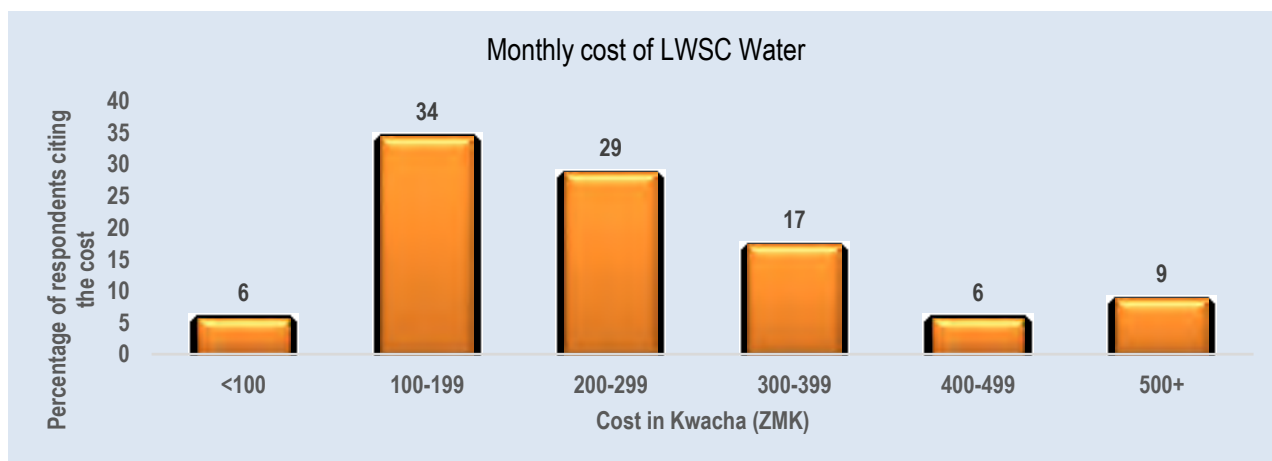


Figure 5: Monthly cost of LWSC Water

***LWSC supplying water every time of the day or night***

91% of respondents reported that LWSC supplied them with water every time of the day or night while 9% said that was not the case.

***Anyone ever suffered from diseases suspected to be waterborne***

91% of respondents reported that no one had suffered from a disease suspected to be waterborne and 9% reported that someone had a disease suspected to be waterborne. The disease in question was diarrhoea.

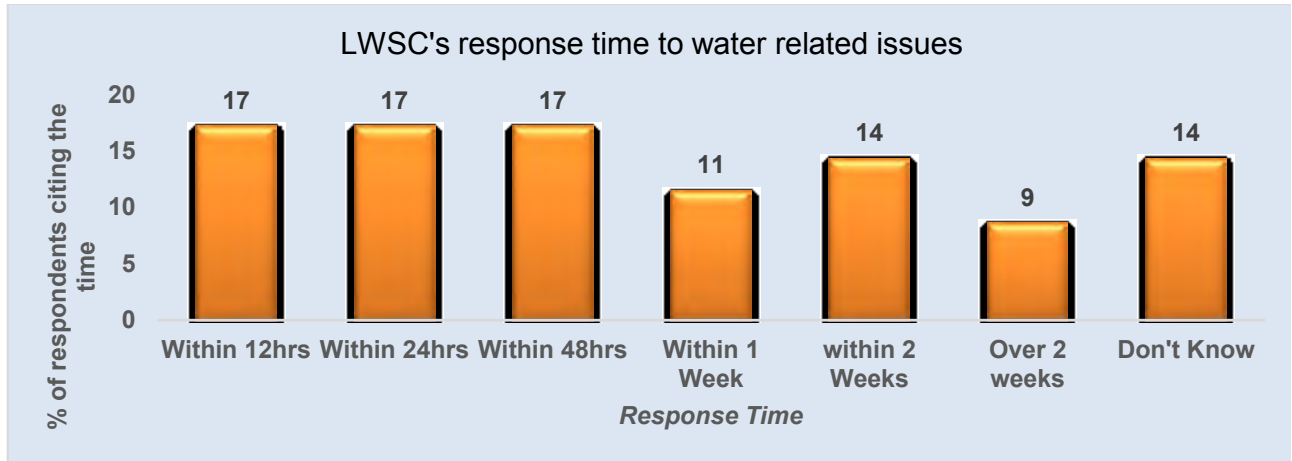


Figure 6: LWSC response time to water related issues

***LWSC's response time to water related problems***

Figure 6 shows LWSC response time to water related problems. The response periods of within 12 hours, within 24 hours and within 48 hours were each reported by 17% of the respondents. This was followed by 14% of respondents who reported that LWSC responded within 2 weeks after being notified. 11% said LWSC would respond within a week after being notified and 9% mentioned that LWSC would take over 2 weeks.

***Customers' level of satisfaction with water services offered by LWSC***

Majority of respondents were satisfied with water services offered by LWSC. This was indicated by 43% who reported that they were satisfied and 40% who were very satisfied. 14% were barely satisfied and 3% were not satisfied at all.

***Decentralized water supply system***

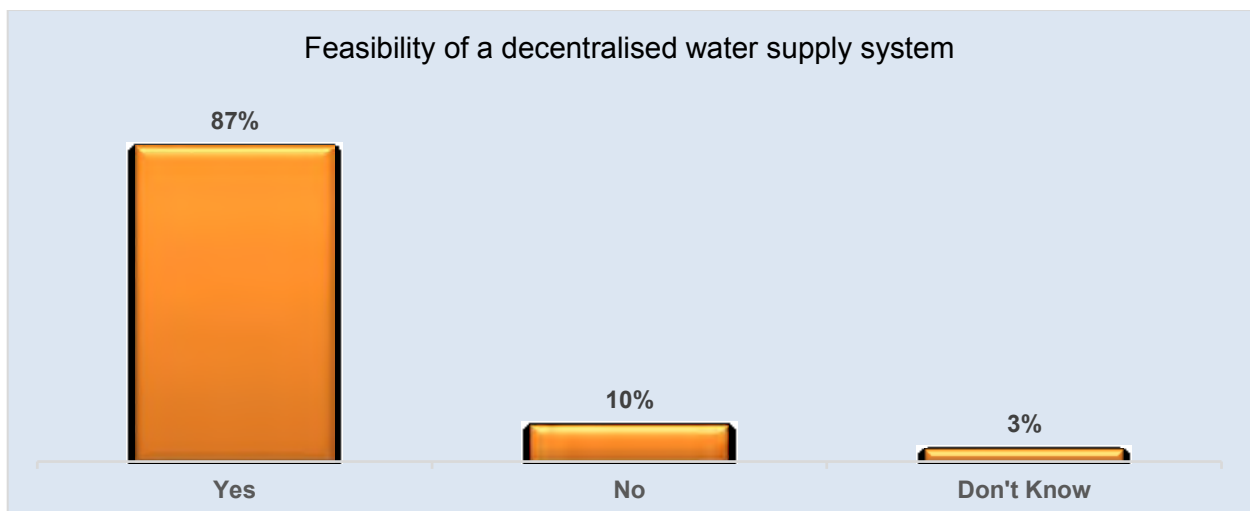


Figure 7: Feasibility of a decentralised water supply system



## Physical, Chemical and Microbiological quality of water results

Table 3: Results for Physical and Microbiological test of water

Parameter	Sample 1 Chalala Salena	Sample 2 Chalala Salena	Sample 3 Libala Stage 3	Sample 4 Libala Stage 3	Sample 5 Chelstone Obama	Sample 6 Chelstone Obama	WHO Guideline (Maximum Permissible Value for drinking water)
pH	6.90	6.98	7.03	6.97	6.07	6.97	6.5-8.5
Turbidity (NTU)	4.76	8.96	9.57	8.41	12.8	9.14	5.0
Conductivity ( $\mu\text{S}/\text{cm}$ )	681	358	328	336	416	910	1500
Total Dissolved Solids(mg/l)	354	184	168	173	215	483	1200
<b>Bacteriological Results</b>							
Total coliforms (#/100ml)	95	98	0	0	TNTC	80	0
Feacal coliform (#/100ml)	80	70	0	0	TNTC	70	0

Figure 7 shows the response of respondents from both households with boreholes and those with piped water who were asked whether they thought having a decentralized water supply system for new residential areas was a good idea. Over three quarters (87%) reported that a decentralized water supply system was a good idea while 10% reported that it was not a good idea. Only 3% did not know whether it was a good idea or not.

### Suggested Ways of improving water supply services delivery by LWSC

When asked to suggest ways in which they thought governance and delivery of water services would be improved by LWSC, water consumers suggested eleven categories of themes which included:

Replacement of old leaky taps in various households and the installation of decentralised boreholes, reduction of tariffs, increased notifications in case of water supply interruption and improved customer service both by personnel and in terms of coverage. Respondents also indicated that LWSC can use Public-Private Partnerships as a way of leveraging operations and expansion into new areas. Improvement of the metering systems was another suggestion cited. This is because some bills received by consumers were either inflated or unrealistic.

Improved water quality monitoring was emphasized by the respondents. Other respondents thought extending water services to the areas not yet connected would be a show of improved service delivery.

### Results from the Management Interview and secondary sources

The findings were as follows;

- (i) LWSC had no documented operations strategy
- (ii) Overall institution framework is based on the legislative framework which shows key places in the water sector and the laws that governs the establishment of LWSC.
- (iii) The quality of the water product supplied to households is LWSC highest competence
- (iv) LWSC main challenges include among others; limited capacity in terms of water versus demand, lack of operational and maintenance materials, aged infrastructure and also limited investment in expansion projects.
- (v) LWSC has put up strategies in place to address challenges which are mostly imbedded in the Lusaka Water Supply Investment Master Plan and the strategic plan 2014-2018. Some of these strategies are to; increase design capacity, address tailored extension of the distribution network and the required increase of storage capacity, improve efficiencies in the control and repair of leaks, develop and implement water safety plan, utilise ground water resource model, construction of new water resources, reduction of water production and transmission losses ,implementation of asset management policy etc.

- (vi) Considerations to decentralise boreholes are still strong for LWSC. However, it has been noticed that boreholes are not always sustainable and can fast become unreliable.
- (vii) The main resources that LWSC needs to connect upcoming residential areas are monetary resources (from funders and partners), Materials for network construction, such as pipes, pumps, valves etc and the water resource.
- (viii) LWSC has plans to work with real estate stakeholders which are already in place.
- (ix) There is little room in LWSC plans for subcontracting for the various stages in the water supply chain
- (x) The two key core competencies that LWSC needs to nature were identified as time and cost.
- (xi) Delivery of water supply services can be improved in the upcoming residential areas through favourable policies by the government and the sector regulator, NWASCO

## DISCUSSION OF FINDINGS

### Households with boreholes

The data collected in these households helped assess if boreholes and borehole water had any competitive advantage in terms of cost, quality, time and flexibility. Chalala and Chelstone Obama were selected because these were two prominent examples of new and upcoming yet to be fully connected by LWSC to the main water supply network and thus mostly rely on borehole water for household use. It was realized that 74.5% of respondents had spent over K10,000 to drill and install their borehole. The average cost across all households was K 17,425. Out of all respondents, 38% submitted that their boreholes had broken down and needed repairs. The average cost of repairs was reported to be K 1.819. Looking at the cost incurred in terms of construction, installation and maintenance of individual household boreholes, it would be more convenient, and cost efficient for the residents to be supplied from a single source that is managed and maintained by the water utility company.

It was also observed that boreholes were very flexible in terms of access and therefore households could get their water whenever they wanted. However, some respondents submitted

that during peak dry seasons, drawing water from boreholes can be challenging because the water levels fall too low thus making boreholes unsustainable.

### Households with piped water

The data collected from household with LWSC piped water supply helped assess the competitive advantage that piped water had in terms of cost, quality, time and flexibility. Libala area was chosen because it was one of the areas that was observed to be receiving continuous water supply prior to the research and could serve as a benchmark if connection is extended to the upcoming residential areas of Lusaka. From the survey and as illustrated in figure., it was discovered that over 60% of respondents thought LWSC services were affordable based on the quality of service they were receiving. About 63% of respondents were spending about K100 to K300. This was for an average household of 8. In terms of water quality, majority of respondents (71%) thought that it was good. This was validated by the water quality test results shown in table 3. 91% of respondents from Libala perceived the quality of the water supply service as flexible. This is because they were able to access the water service whenever they needed it, every time of the day or night. This made the respondents have a customized feel towards the water supply service being received. Overall, 83% of households with piped water were thought to be generally satisfied with the water supply service that was being rendered.

Respondents observed different response time to water related issues by LWSC. Figure 6 shows that a little over half of the respondents (51%) had LWSC respond to water related issues at least within 48 hours.

### Physical, Chemical and Microbiological quality of water supplied in the selected residential areas

Two water samples were taken randomly from each selected household locations, i.e. Chalala, Libala, and Obama. These samples were analysed physically, chemically and microbiologically. Table 3 illustrates the physical and microbiological results. All physical parameters for both LWSC and borehole water were within acceptable values

recommended by the WHO except turbidity which was relatively higher. All chemical parameters for both piped and borehole water, with the exception of Nitrates in Chalala, were within the recommended limits. High presence of nitrates can result from improper well construction, well location or improper disposal of human and animal waste through the septic system (cdc.gov/healthwater/drinking/privatewells/nitrates). The borehole water from both Chalala and Obama tested for high levels of total and faecal coliforms while no amount of coliforms was found in piped water supplied by LWSC. The average distance between septic tanks and boreholes was determined as 7.6 meters. This was thought to have been one of the contribution to the microbiological contamination in boreholes as it fell short of the 30 meter distance recommended by World Health Organisation (WHO, 2006). The results of contaminated borehole water were in line with previous studies done in similar localities. For example, a microbiological assessment of water in Libala South indicated extensive microbiological contamination of the groundwater (Nakaonga et al, 2017).

### **LWSC Situation Analysis**

The findings from informants revealed that LWSC had clearly documented policy or framework with regards to the monitoring of the quality, cost, time and flexibility of service delivery in upcoming residential areas. However, the regulator, National Water and Sanitation Council (NWASCO) stipulates the service standards that the utility company, in this case LWSC must comply to as they supply water to the consumers. This is done through Service Level Agreements and Guarantees (SLA) that the water utility company is required to have by NWASCO to guarantee customers with a defined level of service. Water quality monitoring is done through watch groups which are also set up by NWASCO. NWASCO also sets the water tariffs for the water service.

The competitive position of an organization is determined by the dimension of Quality, Cost, Flexibility and Time that the organization possesses. The findings of the research showed that LWSC is always meeting the set standards and guidelines for safe drinking water. This was LWSC's highest competency. Water tariffs were seen by the consumers to be good. However,

LWSC considers the tariffs to be too low and not reflective of how much it costs to produce and distribute water. The Flexibility dimension is not good and usually depends on the area where one is. The areas which receive water continuously will always have the flexibility to access the water anytime. Due to lack of adequate operational and maintenance materials, such as safety equipment, valves, compressors, pumps, lubricants, gaskets etc the competence of time or speed of delivery is not always met.

The main challenge that LWSC faces with regards to connecting new residential areas is the inadequate amounts of water because the current demand for water in Lusaka is higher than the utility company's production capacity. The other challenge is the old dilapidated water network infrastructure, some of which is over 40 years old. The utility company also lack adequate financial resources to enable the extension of water supply coverage to most of the upcoming residential areas (Ndongwe, 2013).

According to LWSC data (2010), very high Unaccounted for water (Ufw) and Non-Revenue Water (NRW) calculated rates being 47.5% and 47.2% respectively are also a big challenge for the water utility company. According to NWASCO the performance indicators for NRW are; Good < 20%, Acceptable 20 – 25% and Unacceptable > 25% (Millennium Challenge Corporation, 2011). The failure of the LWSC to reach the acceptable levels of NRW is an indication of how poor the utility is managed and illustrates that the utility investment in proper metering and piping systems is minimal.

In order to mitigate the various challenges that LWSC faces with supplying water to the new residential areas of Lusaka, a number of strategies have been developed. The main strategy that stands out is the Lusaka Water Supply Investment Master Plan (ibid). The ultimate object of the plan is to attain 100% access to safe water by 2035 and 80% access by house connection in 2035 (from current 35%). Other mitigating strategies are outlined in LWSC Strategic Plan (2014-2018)

So far under the Millennium Challenge Account tailored extension of distribution networks are being extended to Ndeke and Kwamwena through use of decentralized boreholes. The Kafue bulk project (150 million dollar project) is also underway and will bring in an addition of

50,000 m<sup>3</sup> per day into Lusaka( LWSC, 2017). To ensure sustainability through revenue collections, LWSC with technical assistance from the Millenium Challenge Account Zambia procured a state of the art water meter test bench in the second half of 2018 and provided training to its employees in the operations of the same. The test bench will help in ensuring that only correct reading, durable and recommended water meters are installed in households. This will go a long way in mitigating Unaccounted for water(Ufw) losses and Non-Revenue Water(NRW). Within the same year, tenders for the procurement of prepaid meters, pipes, fittings and accessories were also tabled. This is help in ensuring that some of the old infrastructure is replaced and hence afford LWSC time to look into upcoming areas.. In line with strategic objectives, LWSC in 2016 endeavored to implement the asset management policy by establishing prioritized asset management capabilities and competencies of LWSC (mcaz.gov.zm).

Over the years, LWSC Company has capitalized on the available groundwater resources. By 2010, LWSC had 92 boreholes which were providing about 60% of the daily production and currently there are over 100 boreholes that feed water either directly into parts of the distribution system where they are located or serve satellite peri-urban areas (Millennium Challenge Corporation, 2011). Considerations to decentralize borehole operations are still there as seen in the case of Meanwood Ndeke and Kwamwena. However, the informants submitted that boreholes were not sustainable due to high installation and operation costs and changing climatic pattern which makes them unable to yield water throughout the year and thus are fast becoming unreliable. Apart from this, Lusaka's aquifers water yield is below the demand for the city (Future Climate for Africa, 2016).Therefore, the general management direction is water to come from a surface source for example Kafue River. However, this is not to make boreholes obsolete, but they will still be considered useful in places where there is no opportunity or chance to connect using surface water.

The main resource that will be needed for LWSC to connect the upcoming residential areas is the water resource. Water generation is LWSC biggest challenge. If there is no source of water,

water cannot be supplied. If a source is established, the other critical resource that will be need is the financial resource. This is a governance issue. Monetary resources can be obtained from the government of Zambia, donors and other private stakeholders and partners. However, it was noted that for the sake of future sustainability, LWSC will need to develop capabilities to start funding major projects by itself. The financial resources will enable the water utility company to increase the hydraulic capacity of the network.

### **Plans for Real Estate Stakeholder Engagement**

One of LWSC on going strategies in connecting new residential areas is to work with the private real estate stakeholders. With these strategies in place, real estate providers usually solicit the guidance of LWSC during the construction phase and then hand over the water reticulation system to LWSC to maintain and operate after the housing projects are done. In this way, LSWC's burden for connecting such areas is eased. An example of an area which was developed by real estate providers and has now been handed over to LWSC in Lusaka is Roma Park in Foxdale.

### **Room for Subcontracting**

LWSC currently has no plans to subcontract for the various stages that consist the water supply process which are production, transmission and distribution. However, the respondents agreed that such an idea could work to bring about efficiency in the water supply systems but had also its own disadvantages. The disadvantage is that if one side slacks, the blame can fall on the other that might not even be the cause of the slack.

### **Key Competitive priorities to nurture**

The competitive priorities of time and cost were identified as the two main competencies that LWSC should nurture if it has to supply water to upcoming residential areas of Lusaka. The time competence can be realized through Asset Management. Asset Management entails LWSC getting to know both their assets and condition of the assets. If the condition of the assets is known, LWSC will know which assets to overhaul or repair through wise investments. Having assets which are in good condition will reduce the time that is spent on reactive maintenance in areas

which are already connected and LWSC will thus focus on extending connections to new residential areas yet to be connected.

The cost of the water that LWSC supplies is generally affordable for most consumers. However, the research discovered that this is not a real competitive advantage for LWSC because the cost of production of the water is way above the revenue that is realized from water bills. LWSC will need to address this problem with NWASCO to balance the price of water with the cost of production.

### **Ways of improving the governance and delivery of water service in the upcoming residential areas-Managements View**

Governance and service delivery can be improved through the establishment of favorable policies by the government and the sector regulator. Currently, there seem to be lack of adequate tariff level and performance improvement policies. Favorable policies will see to it that there is a firm institutional framework established that will address water supply issues with regards to cost, quality, time and flexibility.

### **Feasibility and acceptability of LWSC putting up decentralised water supply systems.**

The feasibility of LWSC putting up decentralised water supply systems was analysed in terms of operational requirements, market requirements, and technological, legal and economic requirements. LWSC was thought to have all these requirements in place or at least easily available and hence the idea of putting up decentralised water supply systems through use of boreholes was considered to be feasible. Decentralisation was also acceptable by the majority of respondents.

### **CONCLUSIONS**

This study established that LWSC has no clearly documented institutional policy or framework with regards to operations strategies for monitoring of water service supplied in new residential areas in terms of quality, cost, flexibility and time. The main challenge that LWSC faces in terms of connecting new areas is limited financial resources. This translates in the limited capacity of the water treatment plants which has resulted in less supplied

water than demanded. Moreover, it has resulted in poor investment into pipe network maintenance and renewal. The worn out and aged infrastructure, some of which estimated to be over 40 years old, leaks a lot of water and reducing leakage has been difficult as the frequency of breakdowns is high. This results in high maintenance costs and takes away valuable time that is needed to extend coverage to new residential areas.

The investigation of physical, chemical and microbiological quality of water in the selected areas of Lusaka revealed that piped water from LWSC was more reliable than borehole water in terms of quality. Borehole water in Chalala and Obama was found to be contaminated heavily with total and fecal coliforms.

Putting up a decentralised water supply system was determined as feasible and acceptable even though LWSC had indicated that it was trying to shift direction from boreholes to surface water.

### **RECOMMENDATIONS**

The following recommendations were made to LWSC;

1. Initiate a capacity strategy by fully implementing the Asset Management Policy in order to determine which infrastructure to replace with new ones.
2. Configure resources and processes to focus on speedy and timely delivery of services.
3. Involve community and private investors in endeavors to improve and extend coverage to new residential areas.
4. Decentralize water supply to new residential areas and sensitize residents on having a decentralized reticulation system for cheaper and safer drinking water.
5. Consider subcontracting the stages of water production and transmission in order to increase efficiency
6. Management should develop properly documented operations strategies and make them known to the employees.

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