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Title: **The influence of operational efficiency and water tariffs on cost recovery in the water sector: A case of Lukanga Water and Sewerage Company - Zambia**

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Summary

The majority of Governments in emerging economies contend with scarce financial resources needed for the expansion of strategic infrastructure which is vital for the improvement of the social and economic wellbeing of societies. This is due to high budgetary shortfalls and inadequate domestic capital financing alternatives. Although the debate on the best way forward is not conclusive, commercialisation of the water industry rather than full privatisation seems to be the most favoured in the developing nations. This was the premise on which the Zambian water sector was restructured. Commercialisation for the water industry in Zambia was established on seven tenets as specified in the National Water Policy(NWP) (Schwartz, 2008). The third (3rd) NRW principle devolved authority to Water Utilities to function on commercial principles. The expectation under this principle was gradual achievement of full cost recovery by the established water utilities (Republic of Zambia, 1994). Full cost recovery in this case denoted covering of operations and maintenance costs, finance costs, depreciation and any allowed provisions(NWASCO, 2016). However, achievement of this goal has not been easy for most of the utilities in Zambia. A case of Lukanga Water and Sewerage Company (LgWSC) was selected to establish the factors responsible for the failure to attain the expected target of cost recovery in most of the Zambian water utilities.

The theoretical context for the study was anchored on two main theories; the water pricing theory and the modern management theory approach on the efficiency and effectiveness of organizations. The main concept of study 'cost recovery' is founded on the principle that service providers should recover cost related to the provision of the services. The study was mainly explanatory and took a qualitative approach. Two main data collection tools were employed to obtain the primary data for the study; semi-structured interviews and closed questionnaires. The main supposition of taking this type of inquiry was that the blend of interviews and questionnaires would offer a much more complete understanding of the study problem than either research tool could provide (Creswell, 2013). Secondary data from existing literature and legislation was used to augment the primary data collected.

From the findings of the study, it can be conclusively said that operational inefficiencies and low water tariffs have significantly contributed to the failure of the water utility to attain the expected target of cost recovery. The study has shown that operational inefficiencies denoted as water losses, bill collections and staff productivity combined with the effects of the low water tariffs, explained the failure to recover costs. Operational inefficiencies both on the cost side and the revenue side of operations have been adversely influencing the utility's ability to achieve the targeted cost recovery. Furthermore, the situation was exacerbated by the fact that LgWSC had the lowest tariff in the sector. A unit of water tariff per cubic meter was therefore not able to cover a unit O&M cost per cubic meter. Additionally, the high operational costs coupled with low collections further restricted business growth. Even though operational improvements were visible from the time the water utility was commercialised, the lack of investment in business growth threatened the sustained capacity of the operational improvements so far achieved in the water utility.

This study supports the view that substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without necessarily raising water tariff rates (Gupta 2011). Therefore, by having operational efficiency in management of water losses, in bill collections and labour productivity small 'quick wins', in revenue would be achieved. Focusing on the water pricing policy alone will not yield the desired outcomes for the sector. The study has recommended more applied research that quantifies in monetary terms the operational gains that would accrue to water utilities in the developing countries to aid utility managers and policy makers make more focused decisions for the sustained growth of the water sector in developing countries.

Keywords:

Cost recovery, water tariff, operational efficiency, water losses, bill collections, staff productivity

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Abbreviations

AfDB	African Development Bank
BMS	Bulk Messaging System
CUs	Commercial Utilities
GRZ	Government of the Republic of Zambia
HR	Human Resource
IBNET	International Benchmarking Network for Water and Sanitation Utilities
IBT	Increasing Block Tariff
IHS	Institute for Housing and Urban Development
LAs	Local authorities
LDC	Less Developed Countries
LgWSC	Lukanga Water and Sewerage Company
MCP	Marginal-cost pricing
MDGs	Millennium Development Goals
MLGH	Ministry of Local Government and Housing
MMS	Management Maintenance System
NWP	National Water Policy
NRW	Non-Revenue Water
NWASCO	National Water and Sanitation Council
O&M	Operation and Maintenance
PMS	Performance Management System
SLA	Service Level Agreement
SLG	Service Level Guarantees
US$	American dollar
WSS	Water Supply and Sanitation

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Chapter 1: Introduction

1.1 Background of the study

Governments in developing countries are faced with deficient resources for the development of strategic infrastructure which is vital for economic and social development. This has been mainly attributed to the fact that most governments are faced with high fiscal deficits and inadequate domestic capital financing making it difficult for them to raise funds to rehabilitate and let alone fund new infrastructure projects (KPGM, 2010).

Privatisation of the sector has been viewed by neoliberal models as a practical alternative option of raising the needed funds for such vast investments. Others however, have argued that this is an inappropriate policy prescription (Dagdeviren, 2008). Some scholars have proposed full privatisation to tackle this whilst others have advocated for partial privatisation or commercialisation. (Hukka and Katko, 2003). Full privatisation in this case, entails the sale of part or all public infrastructure of a municipal entity to private enterprises through the diverse arrangements of Public-Private Partnerships (PPP) whilst *commercialisation* has been used when state enterprises use private business principles to operate in order to improve operational efficiency. The inclination in the recent years worldwide in the water services sector, has been to commercialise in contrast to complete privatisation of the public utilities. (Chitonge, 2011). In the Zambian scenario, commercialisation of the water industry rather than full privatisation has taken place. The option most strongly promoted during the reform period included the creation of commercially operated water utilities which despite being owned by government would function on commercial principles (Schwartz, 2008). These urban water sector reforms implemented in Zambia, are not just limited to the case of Zambia but rather reflect the general trend across in many other developing countries.

The intended outcome of commercialization reforms introduced across most African countries, utilities was for the pursuit of achieving efficiency and effectiveness in resource allocation and utilisation. Most governments, especially in the developing countries, could no longer support the colossal waste and inefficiency of the public sector, the agenda of privatisation and commercialisation was established to address the management of the public sector (Kalejaiye, Adebayo, et al., 2013). In the face of insufficient inputs and rising inadequacies in service coverage, water providers in Africa require to function both efficiently and effectively.

Bakker and Cameron (2005) have also iterated that amongst the choices why government might opt for arrangements of independent, public organization such as a water utility using private principles, is efficiency. The quest for profit, which stirs private firms, fosters a desire to operate with utmost efficiency in the use of available resources. The modern approaches to management theory in its perspective on organisational effectiveness as explained by Cole and Kelly (2004) have defined efficiency as executing or operating in the most excellent manner with least waste of time and effort. They have differentiated efficiency from effectiveness which describes the competence to achieve a task according to its intended or planned result.

A private participation perspective (or commercialisation) to water provision apart from its emphasis on efficiency, similarly addresses the importance of full cost recovery for the sustainability of urban service provision. Reviewed literature draws a positive relation between cost recovery and service delivery. The World Bank (2006) has said that a utility that does not cover its costs will inevitably cut back on essential expenditure needed to provide reliable services. Further, Esmaili (2012), has said that failure to attain full cost recovery on water services impacts negatively on asset management capabilities as maintenance expenses are deferred thus compromising the future efficient functioning of assets.

Cost recovery is generally known as a critical component in sustainable provision of water services. However, cost recovery has for some time been a debated topic by experts in the water resource management field. According to ERM (2003) throughout the 1980s, two opposing factions have been noted. On one side, experts of the World Health Organization & UNICEF, have argued that health and social benefits associated with water supply adequately vindicates the delivery of basic WSS using government and donor funds to those in need of it. On the other side, economists in the World Bank have claimed that availing WSS amenities to users incapable or reluctant to reimburse the expenses incurred was a recipe for a disastrous end and a cost to future generations. ERM (2003) have said that, over the years, the arguments in the WSS sector have mainly steered towards debate on what costs needed to be incorporated in cost recovery approaches and where the expected sources for funding recovery of costs would to come. They have indicated that what is generally recognised is for users to pay for recurring costs however, differing opinions still exist on whether to charge users for partial or full capital costs. Notwithstanding this, Annez (2006) in a study on urban infrastructure finance from private operators, has described the objective of full cost recovery from users as being practically questionable due to the need of subsidising the majority poor in society. The study has shown how difficult it has been for many countries to achieve full cost recovery in the water sector. Nevertheless, full cost recovery remains a significant indicator for the financial sustainability of service providers.

Water pricing theory as suggested by Mohayidin, Attari,et al., (2009) has articulated various methods of how water has been priced in various nations. The financial basis of water pricing is founded on the notion that the supplier must be able to recover full supply costs. Water tariffs therefore, are expected to indicate the financial implication on society for the use of water (Dharmaratna, 2011).The cost recovery or revenue recovery principles have been accepted worldwide in state operated enterprises pursuing business principles in the pricing of the water commodity.

1.2 Problem statement

The National Water Policy (NWP) of Zambia outlined seven principles on which the commercialisation of the water industry in Zambian was anchored (Schwartz, 2008). The third (3^{rd}) principle of the NWP permitted for the formation of CUs to operate water facilities using private sector principles (Republic of Zambia, 1994). Lukanga Water and Sewerage Company is one of the eleven water utilities that were created after a successful build and transfer agreement between the African Development Bank (AfDB) and the Government of Zambia. Prior to this water services provision was under the charge of Municipal councils whose performance had become conspicuously incapable of delivering the expected service owing to insufficient funding from government (Chitonge, 2011). From the commencement of operations, the Zambian water utilities have been striving to attain full cost recovery. The NWP in its 4^{th} principle set " the achievement of full cost recovery for the water supply and sanitation services through user charges in the long run" (Republic of Zambia, 1994 p. 28). This was to be done through cumulative increase of user charges and through escalating efficiency in operations (Schwartz, 2008). The water regulators report, (NWASCO, 2016 p. 12) cited the background paper of the 1994 National Water Policy the "Final Discussion Document: Proposed Institutional Framework for the Water and Sanitation Sector" as promoting as one of the financial objectives of the Commercial Utilities the objective "to achieve financial viability within ten years from their establishment". The expectation under this principle's background for the created water utilities was achievement of full cost recovery within ten years of the corporations' establishment.

The water sector regulator in Zambia – the National Water Supply and Sanitation Council (NWASCO), has specifically taken cost recovery as the capability of CUs to recover O&M costs using revenue from user fees (NWASCO 2016). The regulator's definition of full costs includes; operations and maintenance, finance costs, depreciation and any allowed provisions Recovery of these costs is anchored on distributing costs amongst users in accordance with the burden imposed on the delivery procedure. The tariff system which sets the pricing of water has therefore been tailored to reflect these costs fully. The regulator has indicated that the primary aim of the tariff system is to recover O&M costs whilst progressing towards full cost recovery. They have also indicated that the capacity to recover costs is grounded on having both a satisfactory rate of bill collections and non-revenue water.

LgWSC has not been able to attain 100% operations and maintenance cost recovery in the past decade of existence. The operations and maintenance (O&M) cost recovery indicator at the end of 2016 was at 85% which is below the required sector bench of 100 to 150% (NWASCO, 2017). This low O&M cost recovery rate is also reflected in the other service delivery indicators. The competence indicator for collecting user fees commonly referred as collection efficiency was at 83% against a minimum acceptable sector standard benchmark of 85%. The Unaccounted-for Water (UfW) was at 43% against an acceptable sector standard of 25% (NWASCO, 2017). This UfW indicator shows that 43% of the water produced was being lost and was not being accounted for varied reasons. The water coverage stood at 74.8% whilst the sanitation coverage was at 39.5%. Both these indicators are against the sector benchmark of 80%. The implication of the water coverage indicator is that 25.2% of the inhabitants in central province are not provided with safe piped water services whilst the sanitation indicator shows that 60.5% of the population has inadequate sanitation services. The staff cost in relation to billing and collections was at 0.69 against a sector benchmark of 0.54 This indicator reflects the cost coverage of staff expenses against the revenue base. From the performance indicators above, it is evident that LgWSC has had a number of operational challenges in the past decade of its existence. Poor collections and high volumes of water losses and high staff costs have contributed to the inability of the company to achieve sector benchmarks for cost recovery.

Even though utility operations in reality have several dimensions of efficiency, Marin (2009. p.4) has said operational efficiency "can be broadly captured by the management of three main factors: water losses, bill collection, and labour productivity". Management of these three factors is of immense value for a successfully operated utility. According to Gupta (2011) substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without necessarily raising water tariff rates. Therefore, by having operational efficiency in management of water losses, in bill collections and labour productivity small 'quick wins', in revenue would be achieved. Esmaili (2012) has outlined a three-tier performance oriented framework for asset management that incorporates organizational objectives models and critical success factors that service providers can use to attain operating efficiency in service delivery. In this model, operating efficiency in the management of services is envisaged to ensure cost effectiveness that enables the inadequate finances raised by way of charging user fees to sufficiently pay for O&M costs.

LgWSC like the other ten utilities in Zambia has employed several operational strategies in its operations in order to attain operational efficiency These strategies follow the broad category that includes strategies on management of non-revenue water, bill collection and staff productivity. Management of non-revenue water strategies include; leak management strategies and water demand management strategies whilst bill collections strategies have been profoundly service withdrawals for defaulting customers. Staff productivity strategies have mainly been through capacity building and staff performance management contracts. Despite all these efforts the LgWSC indicators have shown limited progress in cost recovery. It is in

view of this that a research will be undertaken to investigate how operational efficiency in water loss and bill collections management and staff productivity on the one hand and the current water tariffs on the other, influence the cost recovery ability of LgWSC. Operational efficiency for this research will be defined as the management of "water losses, bill collection, and labour productivity" as proposed by Marin (2009. p. 4).

1.3 Research objective

In Zambia cost recovery is the expected sustainable long-term goal for water utilities, However, this expectation is yet to be realised in most of the water utilities. The NWASCO (2016) shows that eight out of the eleven water utilities in Zambia were below the sector benchmark on the O&M indicator. Despite the increasing water tariff these CUs have continued to operate below expected recovery rates. A study is being conducted therefore, to explain the factors that lead to the failure to attain the expected target of cost recovery. A case of LgWSC has been selected which aims at reviewing in depth two major factors; operational efficiency and water tariffs to explain the possible reasons to which the two factors can be used to understand the failure to attain the expected target of cost recovery which, if not addressed appropriately, can have an adverse effect on performance of the company to deliver water services according to the targeted levels.

1.4 Main research question

To what extent does the influence of operational efficiency and water tariff explain the failure to attain the expected target of cost recovery at Lukanga Water and Sewerage Company?

1.5 Sub questions

1. How do the current water tariffs affect cost recovery at LgWSC?
2. How does operational efficiency in water loss, bill collection and staff productivity affect cost recovery at LgWSC?
3. What other operational factors affect cost recovery at LgWSC?

1.6 Significance of study

Much of the academic research has gone into the understanding of whether the intended purposes for institutional changes in the much-emphasised reforms within the water sector in developing countries have yielded results. Most studies have focused on the wide-ranging governance issues. Mbuzi (2012) has indicated that studies on efficiency and effectiveness particularly in the context of African WSS sector, have not been widely researched in earlier studies. The perspective of this study therefore brings useful insights on the critical role of efficiency gains in the management of urban water utilities.

This study attends to the importance and immense potential that efficiency gains can result to service providers by focusing on operating efficiency rather than relying on the pricing mechanism to achieve cost recovery. According to Gupta (2011) substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without necessarily raising water tariff rates This study therefore is of practical significance to a broad spectrum of stakeholders that include; the utility managers, water regulators, government officials in Zambia and remains a topical issue in the academic world.

Within the context of LgWSC, the study will potentially identify critical success factors for ensuring recovery of costs in the business practices of the CU and suggests the appropriate operational focus for implementation to redress some inadequacies that may be existing in

operations. The inferences which can be drawn from the research can be used to introduce improvements in the general operations of the company.

For public bodies like local government policy makers and the sector regulating officials, the focus of the study brings specific issues of the case study that would otherwise not be captured. Evident from previous researches are the numerous factors that can be attributed to impeding cost recovery in water utilities, a case specific approach brings in new insight that could be set as a target for restructuring the financing needs of the sector and gives room for further exploration on possibilities of cutting the financing requirements in the sector taking into account the derived efficiency gains that can be pursued by service providers.

Finally, the study will contribute to the body of knowledge in that it also seeks to understand whether the intended purposes for such vast changes in the sector have yielded the potential efficiency gains that were meant to result from the much-emphasised reforms on commercialization of water sector in developing countries. The subject of full cost recovery remains a topical issue amongst scholars, therefore the specific insights from the study builds on the body of knowledge on the much sort for results of the sector reforms within the ambit of commercialization of the water industry. The study also seeks to validate previous research that have concluded that water utilities need to focus on efficiency gains rather than waiting for the prices mechanism to bring about cost recovery because doing so will be at their own peril. It is thus envisioned that the study will arouse interest for additional studies to the seemingly unanswered question of whether full cost recovery can be achieved for service delivery in such enterprises in the developing countries.

1.7 Scope and limitation of study

The scope of the study will be restricted to the analysis of factors that influence cost recovery with a particular bias on water tariffs and operational efficiency as it pertains to water losses, bill collection, and staff productivity. Other factors such as the affordability, awareness and the willingness to pay which also affect cost recovery will not be extensively covered due to time limitation. Nonetheless reference to the water providers perception and findings from previously conducted studies will be made on these factors.

Further, the study does not fully address the yet unanswered, questions related to the practicability of achieving full cost recovery of total service delivery costs but attempts to put into perspective the pertinent aspects that affects cost recovery in the WSS context of developing countries. It has been said that cost recovery in the early years of an asset's life-span are practically easy to raise. However, full contributions to capital and replacement costs are much more problematic(Fonseca, 2003).

Chapter 2: Literature Review / Theory

2.1 Chapter summary

This section discussed the concepts and models that laid the groundwork on which the final conclusions and recommendations of the study were anchored. It provided clarity of concepts used in the study and brought out the theoretical background and literature reviewed on the variables identified in the study. It has been said that what differentiates scientific research from ordinary research is its thorough methodical and organized controlled approach (Thiel, 2014). On the foundation of information that this chapter shall discuss, the basic features of the ideal scenario for the problem elaborated in the first chapter will be highlighted to assist in arriving at possible distinctive clarifications of the underlying factors affecting poor cost recovery in the case study.

2.2 State of the art of the theories and concepts of the study

The theoretical frame for this study is based on two main theories; the water pricing theory as articulated by Mohayidin, Attari, et al.,(2009) and the modern approaches to management theory in the perspective of organisational effectiveness as explained by Cole (2004). The perception of 'cost recovery' in water resource management is established by the principle that service providers should recover cost related of the provision of the services (ERM, 2003). Water pricing, the means by which cost are recovered, is based on the 'revenue-recovery principle' as described by Mohayidin, Attari,et al., (2009). Modern management theories as articulated by Cole (2004) have defined efficiency as the ratio of output to input. Operational efficiency in this study explores as far as possible the extent utility managers use available resources to yield the required outputs. The study will use the above approaches to unbundle and isolate the factors that influence poor cost recovery at LgWSC.

2.2.1 Water pricing theory

Water pricing theories as described by Mohayidin, Attari, et al., (2009) explain diverse facets of water pricing used to advance the efficacy of using water in the industry. The debate has been on which costing method to adopt. One is based on average costing with its core principle on recovery for financial reasons called first best pricing method and the other on marginal costs founded on economic reasoning of efficient usage of water called second best pricing method. The general practice on water pricing mechanisms is that it is set in the national interest where the water pricing is used to subsidize sections of the society. Massarutto (2007) has argued that although generally accepted as a core prerequisite, full cost recovery can be at odds with allocative objectives. He has said that the manifestation of each objective depends on what issue are of national interest; that is whether it is funding of infrastructure maintenance and growth or apportioning of the scarce water resources. It is thus proposed that both aspects are approached independently and an appropriate approach to pricing adopted.

The financial basis of water pricing is founded on the notion that the supplier must be able to recover full supply costs. Water tariffs therefore, are expected to indicate the financial implication on society for the use of water (Dharmaratna, 2011).The argument is that economic efficiency, equity and financial viability are critical objectives of the pricing and investment policies of a water utility. In most countries, water pricing is used as a tool to achieve income distribution.

The chief role of regulatory bodies and service providers in the sector is to determine the appropriate price for piped water supply. Regulators countrywide design the pricing policy to

cover the full supply costs. A high price in both developed and developing countries is desirable (Dharmaratna (2011), however, water is usually under-priced in most countries. The damaging long-term effect is that consumers end up having limited and poor quality water services as service providers are unable to invest and expand water service coverage. The EEA (2013), has said that water prices on their own, are unlikely to achieve full cost recovery through the water pricing mechanism, but are nonetheless critical to communicating vividly that safe water being a specially processed commodity ought to be used more efficiently.

In Zambia, the pricing of using the resource is according to the burden imposed on the delivery scheme in the particular region and this is fused with the tariff adjustment process stipulated by the national regulator (NWASCO, 2014). The assumption is that a reasonable extent of steadiness that avoids large tariff variations year by year is achieved; therefore, to the extent possible, the tariffs mirror correspondingly the cost and real economic value of water thereby enabling the correct indicator to users. The regulator has developed the tariff adjustment process based on the ideologies of impartiality and fairness with social consideration. A cost-plus technique of setting tariffs where users pay the expenses of WSS with a fixed component for the provider is used. The tariff system is set to firstly cover acceptable O&M expenditure and gradually the stipulated capital investment implications (NWASCO, 2014). The measure of achievement of objective is based on an acceptable level of collection efficiency and NRW. NWASCO has, since 2000, gradually adjusted upwards tariffs proposed by CUs in order to move them towards full cost recovery.

2.2.2 Management theory

According to Yepes (1990), effectiveness refers to attaining public service goals and is measured according to the percentage of population served within the utility's area of jurisdiction whilst efficiency refers to success in achieving organizational targets at a minimum cost. This is measured by the degree to which the organization optimizes its available resources. In some cases, an effective organization can be inefficient if it achieves its goals at a high cost. Operational efficiency which is the focus of this study, takes the description under the perception of Cole (2004) that explains efficiency and effectiveness. Effectiveness has been loosely described as ‘doing the right things’ (Cole, 2004 p. 9). The qualification for effectiveness becomes clear by observing the service delivery levels. Efficiency in contrast, is described as ‘doing things right’(Cole, 2004 p. 9).

Mbuvi (2012) has explained the variable in terms of not just being able to obtain the highest output with the given resources (efficiency) but also being able to meet customer demands for quality and reliable water supply services (effectiveness). Therefore, qualification for effectiveness in the water sector becomes clear by observing the service delivery levels whilst efficiency is concerned with the most cost-effective option through minimisation of inputs used in the production of the water commodity.

Gupta (2011) has said substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without necessarily raising water tariff rates. Therefore, by having operational efficiency in management of water losses, bill collections and labour productivity small ‘quick wins’, in revenue would be achieved.

2.2.3 Cost recovery

Cost recovery for water service providers entails that the total income recouped from users by the utility is equivalent or more than the expenditure for provision of the services. It is desirable for service providers to have a steady source of revenue that avoids financing hitches in the

organisation. Gupta (2011 p. 2) has given three categories of cost recovery that are commonly used; "(a) operational cost recovery means that the revenues are at least equal to the operating expenses of providing a service; (b) full service cost recovery means that capital maintenance expenditure and costs of capital are also recovered: and (c) full environmental cost recovery includes the external costs of a service, including any environmental damage." The traditional approach to cost recovery worldwide, uses the second category to imply full service cost recovery.

World Bank (2006 p. 78) toolkit also outlines three distinct components of service cost of water services; "Operations and Maintenance (O&M) expenditure, depreciation, and return on capital". In this case, the toolkit explains O&M expenses to include the daily expenditures connected to the provision of the services and maintenance of the existing system. Depreciation is taken to include the decrease in value of assets with time and this decrease corresponds to the replacement cost of assets whilst "return on capital" is measured as "the interest on debt and the return on equity". Cost recovery in the toolkit follows the capital maintenance approach to approximating depreciation by concentrating on measuring expenses required for maintenance of assets to their existing level of service provision. The authors emphasise the need for governments to be clear on what constitutes the total costs of service delivery as full cost recovery gives an indication to how water systems could be viably handled in the long-run. In practice, governments have had justifications for charging lower than full cost to promote social acceptance and their political sustainability (World bank 2006). This is implemented through a subsidy system. The world bank toolkit nonetheless advocates that for water system to attain cost recovery both the elements of tariff and subsidies combined must give the accurate depiction of the full cost of providing services.

Banerjee, Foster, et al (2010) have observed that cost recovery is a stated objective for most water and sanitation utilities in Africa. They said most water tariff system in African nations have established as a policy the objective of at least recovering the operations and maintenance costs. From a AICD WSS survey database (2007), 91% of 21 African countries had an existing cost recovery policy for urban water. However, with urban waste water only 55% of ten countries had a cost recovery policy. In the survey, generally most of the water utilities were expected to recover operations and maintenance (O&M) costs including some investments costs. In another study in Pakistan by Khan, (2007), different cost recovery practices by different countries were cited. Turkey was cited as having its capital cost being recovered in full over periods ranging from 16 to 100 years in various projects, whilst O&M cost were expected to be payable in the following year. The USA was cited to recover capital cost within 50 years whilst making the yearly payment of O&M cost.

2.2.3.1 Factors influencing full cost recovery

Cost recovery is generally known as a critical component in sustainable provision of water services. However, cost recovery has for some time been a debated topic by experts in the water resource management field. According to ERM (2003) throughout the 1980s, two opposing factions have been noted. On one side, experts from the World Health Organization & UNICEF, have argued that health and social benefits associated with water supply adequately vindicates the delivery of basic WSS using government and donor funds to those in need of it. On the other side, economists in the World Bank have claimed that availing WSS amenities to users incapable or reluctant to reimbursement for expenses was a recipe of a disastrous end and a cost to future generations. ERM (2003) have said that, over the years, the arguments in the WSS sector have mainly steered towards debate on what costs needed to be incorporated in cost recovery approaches and where expected sources for funding recovery of costs would to come. They have indicated that what is generally recognised is for users to pay for recurring costs but differing opinions still exist on whether to charge users for partial or full

capital costs. Notwithstanding this, Annez (2006) in a study on urban infrastructure finance from private operators, has described the objective of full cost recovery from users as being practically questionable due to the need of subsidising the majority poor in society. The study has shown how difficult it has been for many countries to achieve full cost recovery in the water sector. Nevertheless, full cost recovery remains a significant indicator for the financial sustainability of service providers. Scholars have discussed several elements/factors that influence the attainment of full cost recovery for service providers. These have been both internal and external. The following were the key factors highlighted:

Tariff structure **-** Banerjee, Foster, et al (2010), in a study of pricing structure for 23 African countries, observed how utilities could recoup costs at consumption levels that were either extremely low or extremely higher than the average levels, as tariff structures were designed to boost the covering of O&M costs at the highest block levels. Further, they indicated that in the majority of third world countries including Zambia, the water price was usually below full recovery of costs in the interest of subsidizing the poor.

Water Losses and NRW - The majority of urban water systems in developing countries have been characterised by substantial losses both in monetary terms and physical terms (Makaya and Hensel, 2014). WSS providers have thus faced water losses which have had serious repercussion on both service delivery and cost recovery. High levels of NRW make cost recovery difficult to attain. NRW denotes water produced by a service provider yet not sold to consumers due to both or either of technical and commercial losses (Mutikanga, Sharma, et al., 2011). Technical losses occur in transit or during distribution, whilst commercial losses occur when water is provided but not paid for or because of theft, including illegal connections. Gupta (2011), in a study of pricing structure for 23 urban local bodies in India, showed how potential revenue gains were recognised with reductions in NRW. It was observed that cost recovery did not necessarily entail the charge of high user charges but instead required that water utilities consider matters of operational efficiency. It was noted that whilst addressing certain aspects of technical losses required substantial capital investment, some components of NRW could be reduced substantially without additional investment, by improving operational efficiency.

Staffing levels - Gupta (2011), have highlighted that having appropriate human resource numbers and attaining a productive workforce were significant challenges for most utilities in India. To maximize organizational effectiveness, utility managers needed to harness the human potential and ensure the right balance of personnel with output.

Metering, Billing, and Collection - The central principle of water service providers is the ability to measure what is billed. Low metering ratio has been found to have a negative effect on billing and subsequently the revenue base (Mutikanga, Sharma, et al., 2011). With less than 100% metering, billing figures and water loss estimations became inaccurate and were frequently understated. The effect of this was that the collections were lower than expected. It was observed that cities with more reliable data were usually those that used volumetric metering on a larger scale, nevertheless, they reported lower levels of collection due to poor maintenance of meters intensified by defective meters during limited supply conditions, the malpractice and wrong meter readings (Gupta, 2011). Commercial losses thus resulted mainly from failure to capture accurate data during data processing. Misra and Kingdom (2012) have argued that it is desirable that human handling of data is minimized to eliminate factors resulting in wrong meter reading, billing errors and fraudulent practices.

Service coverage - Water utilities are capital intensive businesses and they depend on economies of scale to have a reasonable price mechanism (Kasoma-Mbilima, 2011). Each water utility has an optimal size at which it can operate effectively, for utilities that are smaller

than the optimal size, it becomes a struggle for them to attain cost recovery because they mainly rely on the tariff which is dependent on factors such as the ability and willingness of people to pay (NWASCO, 2016). An increased customer base implies a bigger income base for the water utilities. Service coverage thus has a significant influence on full cost recovery.

Service quality - Banerjee, Foster, et al (2010), have suggested that the quality of service impacts on the billing and subsequently the bill collections, in situations of intermittent supply of water for example, they found that there was restricted consumption by customers typically when metered connections were involved because consumers paid only for what they consumed. This meant lower billing for the water utilities. Low billing impacts negatively on full cost recovery.

Financing and Investment - In a study, Hukka and Katko (2003) have said that delivering WSS services is an extremely capital-intensive undertaking. Huge investments, which extend over decades are required. WSS operations have high fixed costs that often reach limits of about 80 percent of operating expenses. The common trend in Africa and Asia has been that WSS are heavily dependent on support from donors (Kasoma-Mbilima, 2011). The sector reforms in most developing countries was seen as an avenue to garner the needed capital injections. Banerjee, Foster, et al (2010) have observed that cost recovery is a stated objective for most water and sanitation utilities in Africa.

2.2.4 Water tariff

Mohayidin, Attari, et al., (2009) have said the oldest debate on water pricing among economists, has been on either to price water using its average cost which would be explained by financial factors of recovery of costs or based on the efficient water use explained by the economic rationale. Pricing theories of water have endeavoured to clarify different aspect of water pricing that possibly addresses the scarcity of water. Mohayidin, Attari,et al.,(2009), have further indicated that the efficient water use apportionment essentially has the highest water resource return for a given unit price of water. They have thus advocated for effective costing of water using the marginal costing principles. However, due to contentions against pricing on marginal cost basis, the “First-best water pricing” or “the revenue-recovery principle” is the commonly used design when pricing water (Mohayidin, Attari, et al., 2009 p.1537).

Banarjee, foster, et al (2010) have explained water tariff in terms of a collection of charges used to create income for water utilities. They have said that a well-designed tariff inspires consumers to avoid careless usage of water and makes service delivery financially sustainable. In terms of waste water services, they observed that most African countries use on-site sanitation to meet their basic needs, as sewerage facilities were very limited.

2.2.4.1 The water tariff structure

Banarjee, foster, et al (2010) have said consumption of water is billed in the following approaches: using fixed cost where the price of water remains constant irrespective of volume consumed; volumetric tariff where the charge is according to volume consumed and usually this is done by metering customers; two-tier costing where both a constant element and a variable component based on volume is charged. They have said most service providers in Africa use an Increasing Block Tariff (IBT). This is where a preliminary basic level block accessed by all consumers considered as lifeline access is given, whilst a higher charge applies to volumes of consumption in subsequent blocks. They have argued that in theory, that the IBT allows for goals of efficiency and equity. The rationale is that ideally the poor are expected to have lower levels of consumption such that by lowering prices for the subordinate brackets of

volume of consumption, water service is more reasonably priced to the poor. High-volume users are billed at a higher rate. The payment structure for sanitation in the various countries varied; it was either be part of the water bill, calculated as a percentage, or it was calculated as a block or fixed-tariff.

Further, in their study, Banerjee, Foster, et al., (2010) observed that when water tariffs are compared with the average cost of production, they gave the precise degree of cost recovery. For example, two sources of utility performance data; the International Benchmarking Initiative (IBNET) and the AICD WSS Survey Database were used to get financial and technical performance data to derive cost-recovery targets. In this study, the IBNET provided operational cost data for water and wastewater systems in Africa. The findings in the study revealed that many utilities in Africa were meeting the elementary operational costs at both the database thresholds (see Figure 1). However, the price of US1.00/m3 was deemed to be enough to cover the full operating costs, given the challenge of water shortages prevalent in those countries. The study concluded that failure to have a full O & M cost recovery was because of the under-pricing of water and operational inefficiencies, which triggered considerable economic pressure in the African nations.

Figure 1: GWI cost-recovery thresholds

Threshold	African utilities	% of utilities achieving the threshold (average residential consumption = 10 m^3)	% of utilities achieving the threshold (average commercial consumption = 100 m^3)
<US$0.20/ m3	Tariff *insufficient* to cover basic operating and maintenance costs	16	3
US$0.20–0.40/ m3	Tariff *sufficient* to cover operating and some maintenance costs	49	3
US$0.40–1.00/ m3	Tariff *sufficient* to cover operating, maintenance, and most investment needs	27	24
>US$1.00/ m3	Tariff *sufficient* to cover operating, maintenance, and most investment needs in the face of extreme supply shortages	9	71

Source: GWI, 2004; Foster and Yepes, 2006; Kingdom and others, 2006; AICD WSS Survey Database, 2007.

2.2.5 Operational efficiency

The world today is experiencing sweeping changes in the economies of both developed and developing countries of moving away from government proprietorship and participation towards free enterprise and increased operation of market forces (commercialisation). The objective of these changes has been in the pursuit of achieving efficiency and effectiveness in resource allocation and utilisation. As most governments, especially in the developing countries, could no longer support the colossal waste and inefficiency of the public sector, the agenda of privatisation and commercialisation was established to address the management of the public sector (Kalejaiye, Adebayo, et al., 2013). In the face of insufficient inputs and rising inadequacies in service coverage, water providers in Africa require to function both efficiently and effectively.

Cole (2004), has explained efficiency as executing or operating in the most excellent manner with least waste of time and effort. They have differentiated efficiency from effectiveness

which describes the competence to achieve a task according to its intended or planned result. Effectiveness has been loosely described as "doing the right things", whilst efficiency, has been described as "doing things right" (Cole, 2004 p. 9). Mbuvi (2012) has explained operational efficiency in terms of not just being able to obtain the highest output with the given resources (efficiency) but also being able to meet customer demands for quality and reliable water supply services (effectiveness). Therefore, qualification for effectiveness in the water sector becomes clear by observing the service delivery levels whilst efficiency is concerned with the most cost-effective option through minimisation of inputs used in the production of the water commodity. The need for an efficient utilization of available resources becomes even clearer when looking at management of expenditures and revenues in a water utility. On the expenditure side, production costs increase over time whilst on the income side, water providers experience low recovery of expenditure due to nationally regulated pricing mechanism (Madhoo, 2007). The rising expenditures coupled with declining incomes mount sufficient pressure on the service provider to use available inputs in more efficient and better ways. Operational efficiency patrols the ability of WU managers to use resources in a cost-effective manner to produce outputs. Marin (2009. p. 4) has said that operations in water utilities have several dimensions, however, in reality, the general operational efficiency of service providers "can be broadly captured by three main factors: water losses, bill collection, and labour productivity". Gupta (2011) has mentioned that the management of these three indicators in any well-run CU is of great significance.

Further, in a separate study of 21 African countries Estache and Kouassi (2002) concluded that efficiency gains exceeded income from customer payments. They concluded that water tariffs in these countries were actually superficially high due to operational inefficiencies. They envisaged that ideally water would to be more available and more affordable with major improvements in the operation of the sector.

2.2.5.1 Water losses management

Majority urban water resource systems in developing countries have been characterised by substantial losses both in monetary terms and physical terms (Makaya and Hensel, 2014). WSS providers have thus faced water losses which have had serious repercussion on both service delivery and cost recovery. Esmaili (2012) has said that worldwide civil infrastructure in municipalities face problems in terms of condition and state of their infrastructure. Dilapidated infrastructures have thus necessitated municipalities to adopt more proactive infrastructure management systems in order to maintain operational efficiency in water loss management. It is therefore crucial that utilities ensure proper maintenance, rehabilitation and replacement planning of the network because utilities that defer operating expenditures are most likely to deteriorate the state of their infrastructure and will incur greater costs to restore the assets in the long run (Esmaili 2012).

Water losses are commonly indicated by the non-revenue water rate (NRW). Mutikanga, et al (2011 p. 327), has described NRW as "the difference between system input volume and billed authorized consumption". They have said that it includes both the apparent losses and real losses as well as the unbilled authorized consumption. They have described real losses as consisting physical losses whilst apparent losses have been referred to as commercial losses which include the nonphysical losses lost in the water supply system. Further they have said that apparent losses comprise four primary elements "customer meter inaccuracy, meter reading errors, unauthorized consumption (theft, meter bypass, illegal connections, misuse of fire hydrants, etc.), data handling and billing errors". Additionally, they have argued that apparent losses can thus be attributed to significant revenue losses for water providers and contribute to distortion of the reality of demand patterns needed for management choices in

water utilities. Commercial Utilities experience apparent losses because of poor water metering practices (Mutikanga, et al., 2011).

Makaya and Hensel (2014) have said that water losses adversely impact operations in most transitional economies and this has resulted in many of them operating at technically low level efficiencies compared to other service providers in developed nations. They have further explained that the high NRW have indicated enormous quantities of losses through leakages unbilled to users and have resulted in serious negative effects on the financial viability of the utilities.

2.2.5.2 Bill collection management

Billing forms the core mechanism in the delivery of water services that propels revenue flows and at the same time comprises the key source of user data (Rao, 2016). Billing has therefore been extremely vital to the success of municipal services. Rao (2016) has said the bill collection process involves the pursuit of debt owed by users of the service and is used to generate invoices for users and forms the foundation of the bill collection management process.

Efficiency in bill collections is measured by the indicator collection efficiency which is the percentage of revenue collected divided by the total bills distributed. Marin (2009) has indicated that low bill collections rates are common in poorly performing utilities due to lax enforcement and customers resent in paying for poor services. Agrawal (2008) argues that managing the invoicing and the payment services has an instant bearing on income streams of utilities. They have argued that effective billing habits entails that customers are billed accurately and at predictable frequencies of preferably a month. Further, payment invoices must capture the exact nature and quantity of services delivered. Inaccurate meter reading and data handling has been a reason why most service providers end up with massive commercial losses in the developing countries which ultimately affects their ability to recover costs.

Commercial losses result partly from failure to capture accurate data during data processing as well as from water theft. Misra and Kingdom (2012) have argued that it is desirable that human handling of data is minimized to eliminate factors resulting in meter reading and billing errors as well as fraudulent practices. The authors have proposed reducing billing fraud by ensuring a uniform tariff. Water service providers are admonished to avoid increasing huge debt by complying with disconnection and reconnection orders whilst paying attention to customers that constitute a greater part of arrears. Agrawal (2008) has also emphasized the criticality of service providers having robust computerized databases of customers that are promptly updated. Critical mechanisms for successful bill management therefore must include reliable customer databases, convenient facilities for customer payments and vigilance in curtailing malpractices. The use of improved technologies like billing on the spot further eases the invoicing task and improves the utilities' collections and ultimately their cashflows.

On the other hand, it has been acknowledged that prevailing institutional arrangements within a utility have a significant impact on whether the above practices bear fruit in the long term. It has thus been proposed that in the shorter term, it is of value to consider subcontracting to the private sector with relevant experience the invoicing and payment process, especially where there is weak capacity in the existing utility structure. Alternative suggestions of drip-feeding payments (e.g. prepayment meters) to improve collection levels from poorer customers have been proposed (Rao, 2016). The argument here is that it is better to embrace phased payments to mitigate short-term variations in income than to incur costs for bad debt recovery packages.

According to Baietti and van Ginneken, (2006), majority service providers have multiple modes of payment choices for users to settle water bills, however accessibility is contingent on the ability of the decision makers in these water utilities to utilize the diverse options

offered by the banking industry. Innovative payment options are thus some of the best practices that successful water utilities employ.

2.2.5.3 Staff productivity management

According to Freeman (2008 p. 5), staff productivity can be viewed as "the ratio between a volume measure of output (gross domestic product or gross value added) and a measure of input use (the total number of hours worked or total employment)". The efficacy with which factors of production (labor) are used in the production goods and services can be weighed by labor (staff) productivity. The quantity measurement of outputs indicates the service output by the workforce whilst the "*input use*" indicates the period, determination and services within the labor force. Input labor "is measured either by the total number of hours worked of all persons employed or total employment (head count)" Freeman (2008 p. 5). It has been contended that the different input measures have their pros and cons associated to the design of the staff productivity measurement. It is acknowledged that the most suitable measure of staff input is the amount of hours worked as mere headcount of staff obscures variations of number of hours worked by use of temporal labor force; the nonattendance and variation in set hours of working and the impact that arises from changes in extra hours of working. The worldwide norm in the water sector, is to measure staff productivity by the number of staff per 1000 connections.

To maximize organizational effectiveness, utility managers need to harness the human potential. Haslinda (2009) has said for organisations to be effective staff must be appropriately deployed and distributed and should be allocated tasks they are capable of doing. The author argues that the human resource comprises the organization's greatest assets needed to support operations. Individual capabilities of staff and their potential needs to be exploited for staff productivity to be achieved.

Rowley and Redding, (2012) have described human resource as the collection of expertise, skills and intelligence. They argue that it is the human component of enterprises that provides the creative thrust that brings innovation and learning needed in business enterprises. Training and development thus form core aspects in human resource management that induces productivity. Chikozho, (2015) observed that conventional sponsoring of trainings on capacity building narrowly focus on the strengthening of skills of single personnel and they concentrate mainly on technical aspects as opposed to improving sets of attributes and HR resources that enable both individuals and organisations to attain and realise desired development goals. The latter is thus recommended to the sector.

2.3 LgWSC profile and context information

According to Cole (2004 p.6), management is "the act of getting people and transformational resources together to accomplish desired goals and objectives - management comprises planning, organizing, resourcing (encompasses the deployment and manipulation of human, financial, technological, and natural resources), leading or directing, and controlling an organization" Accordingly, LgWSC in its quest to manage its people and transformational resources is guided by its vision, mission and strategy in its management style. The Vision guiding vision LgWSC is;

"*To be an excellent and commercially viable organization that provides water, sewerage and sanitation services to the urban and peri-urban customers of Central Province in order to improve their quality of life*"

This vision is anchored on four principles; Integrity, people, teamwork and excellence and the mission is;

"*To provide the customers in the Central Province with reliable and affordable water supply and, sewerage and sanitation services in a sustainable manner while maintaining our independence and public accountability*"

It is currently pursuing a Pareto/TQM strategy that is focused on revenue collection and Non-Revenue Water reduction while at the same time embracing a new culture of team work and continuous improvement to achieve higher levels of quality companywide in order to meet customer expectations. This approach according to the CU's 2015 Annual report, has proved to be more responsive to the changes in the environment and the needs of the customers, employees and its key stakeholders.

It is from this background that this study endeavours to explain the extent to which operational efficiency and water tariffs affects the utility's vision to be a commercially viable organisation that strives to operate the company in a sustainable manner.

2.3.1 Technical and Financial Performance

LgWSC has been striving to achieve its objectives amidst many complex challenges. The Company has been operating with inadequate cash flow mainly due to poor payments especially by Government departments which have affected the Company's ability to reduce its debt to various suppliers and has in most instances found it difficult to carry out many programs that were approved in the budget. The huge debt owed to LgWSC by government Institutions have affected the company's ability to consistently re-invest into water and sanitation Infrastructure.

According to the regulator sector report NWASCO (2017), LgWSC compared to other utilities in Zambia has, relatively new water infrastructure in all its towns but its sewer network is dilapidated. Some of its water infrastructure built in the 1960s however is in a poor state and the limited capacity of some water plants, water supply machinery & pipelines, storage reservoirs and other water infrastructure have affected the reliability of water supply and stifled company operations. The non-existence of adequate sewerage infrastructure in most districts and townships of Central Province coupled with the huge financial resources required to address the issue of low sanitation coverage in the province has been a major challenge for the utility. In its 2016 Annual report, LgWSC has cited the technical challenges that include encroachments into LgWSC wellfields and other properties coupled with the poor planning of some townships which has made it very challenging to maintain and extend service provision to un-serviced areas. Further, unreliable power supply to various water plants and production sites have contributed significantly to disruptions of water supply.

Amongst the water sector challenges outlined in the NWASCO (2017) sector report are the following challenges; " Water losses with about 49% of the water produced lost; low collections, particularly from Government institutions and domestic customers, despite an increased revenue base; low focus on maintenance that exacerbated network failures.; diminishing raw water resources due to climate variability and anthropogenic activities ;poor record-keeping and customer database management hindered effective service delivery and planning.; and lapses in water quality monitoring that reduced regulatory confidence levels in the reported results" (NWASCO 2017 p.7)

2.3.2 Tariff Structure

LgWSC operates within a regulated environment. Water tariffs in Zambia are regulated by the water provider NWASCO. The water pricing system uses a cost-plus system and a block rising tariff structure This water pricing system uses cross-subsidies among categories of customers. where the initial six cubic meters is costed at below marginal cost of product (Kasoma-Mbilima, 2011). Presently, the determination of tariffs is anchored on the tenets of gradual

recovery of costs Full recovery of costs requires that tariffs yield sufficient income for utilities to recover costs of production which include covering the O&M costs, depreciation and elements of capital expendidure. (World Bank, 2006).

According to the tariff guide for water utilities, the water utilities are categorised in the Type 1 or Type 2 categories based on cost coverage level. A type 1 category operates below 100% operations and maintenance and a type 2 operates above 100% (NWASCO, 2014). LgWSC currently falls under type 1 utilities and is thus required like the other utilities in the categories, to operate within the sector benchmark of the production losses and collection efficiency as well as to adhere to the permitted cost structures.

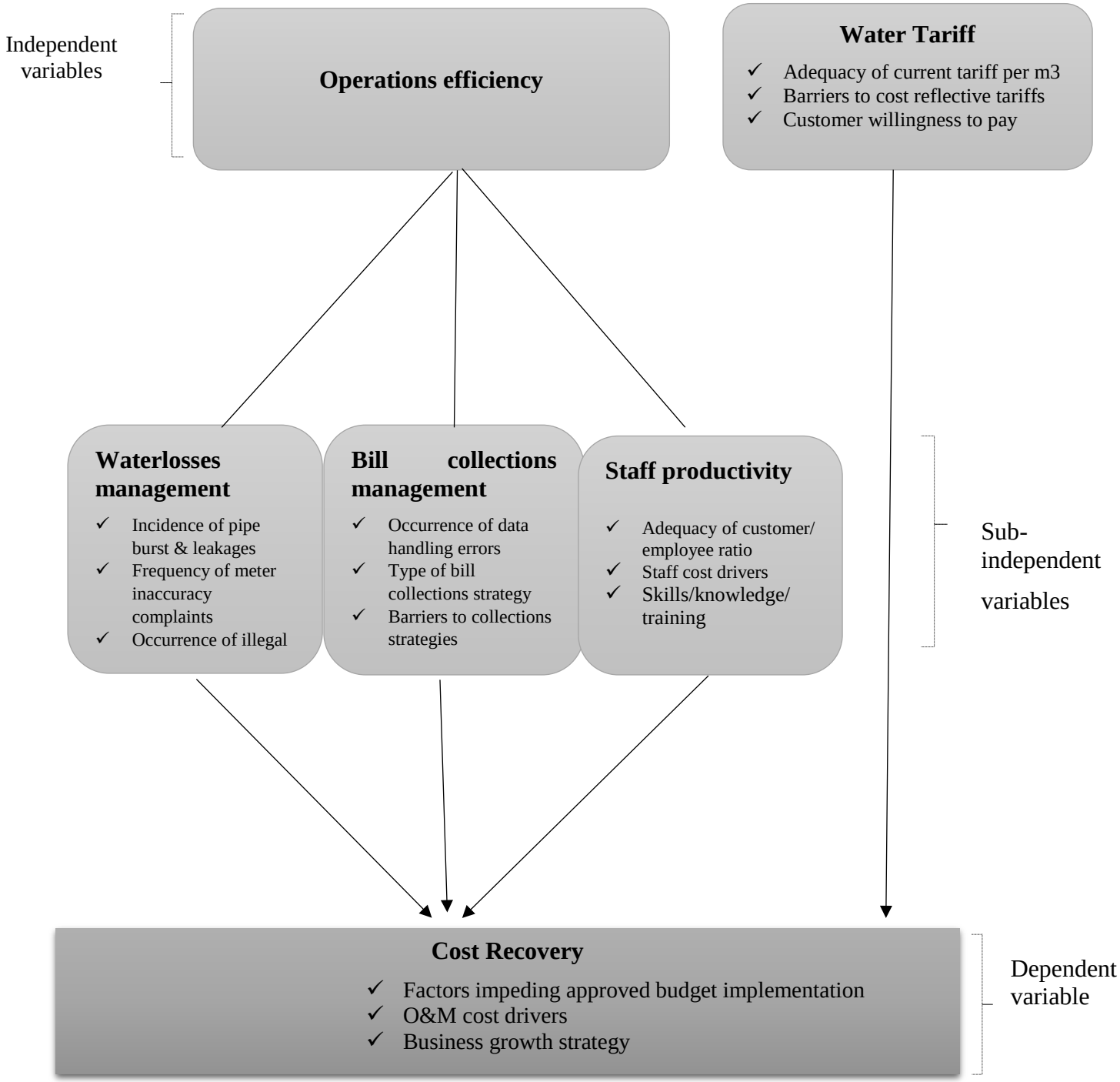
2.3.3 Operational efficiency

The water regulator NWASCO measures operational efficiency of water utilities using established performance benchmarks. The relevant benchmarks are used annually to grade the performance of the water utilities. The Zambian government policy on water sector tariff is intended to ensure the price of services is reflected in the cost of proving services, NWASCO carries out this mandate by ensuring that only acceptable costs are passed on to customers. This implies that water utilities are expected to put in place performance improvement plans founded on cost recovery, operational efficiency, and demand management (Kasoma-Mbilima, 2011). LgWSC has been striving to meet these expectations through prudent management of available resources and by linking performance measures to operations.

2.4 Conceptual framework

The conceptual framework (fig.2) in this research is anchored on the water pricing theory and the modern management theory approaches on organisational effectiveness. Founded on a comprehensive literature review, a conceptual framework was developed to examine the extent to which operational efficiency and water tariffs influence cost recovery at LgWSC. Cost recovery is the dependent variable. Operational efficiency and water tariff have been considered the independent variables. Operational efficiency for this research will be described under three sub-variables; water losses, bill collection, and labour productivity.

Figure 2: Research Conceptual Framework



Chapter 3: Research Design and Methods

3.1 Introduction

This chapter is devoted to a discussion of methodological aspects including data instrumentations that were adopted and implemented in the study. The chapter thus starts with a restatement of the research questions (3.2) then summarizes the operationalization of variables (3.3), the research strategy and type that was used (3.4), data collections methods (3.5), data collection instruments sources and where data was obtained from (3.6), the unit of analysis covered (3.7), the sampling techniques (3.8), data quality-reliability and validity of the research (3.9). and finally, the data analysis methods.

3.2. Revised Research Question(s)

Box 1: Overall research question

Overall research question:

"To what extent does the influence of operational efficiency and water tariffs explain the failure to attain the expected target of cost recovery at Lukanga Water and Sewerage Company?"

Specific research questions

1. How do the current water tariffs affect cost recovery at LgWSC?
2. How does operational efficiency in water loss, bill collection and staff productivity affect cost recovery at LgWSC?
3. What other operational factors affect cost recovery at LgWSC?

3.3 Operationalization: theories, concepts and variables.

Operationalization involves inferring of theory into real and quantifiable entities (Thiel, 2014). There are basically three steps involved. The explanation of variables to be measured, the identification of measurements for those variables and the setting of values to the measurements for ease of interpretation. In this study, the three variables that were defined and measured, include; cost recovery, water tariffs, and operational efficiency. Cost recovery and water tariffs have been explained within the context of the water pricing theory whilst operational efficiency is in terms of the management theories in the framework of efficiency and effectiveness of organisations as argued by Cole (2004).

3.3.1 Water pricing theory

In this study, the "revenue -recovery" method as explained by Mohayidin, Attari, et al., (2009 p.1537), has been adopted. This method of pricing uses an average costing which is explained by financial factors of recovery of costs This method is applicable in most countries, including Zambia. Generally, the mechanism of water pricing is conventionally designed in the national interest to make the water resource available for the vulnerable sections of society. The "revenue-recovery principle" outlined above has thus taken centre stage in the design of water price in most countries.

3.3.2 Management theory

The variable operational efficiency in this study is will take the description under the perception of Cole (2004) that explains efficiency and effectiveness. Mbuvi (2012) has clarified the variable in terms of not just being able to obtain the highest output with the given resources

(efficiency) but also being able to meet customer demands for quality and reliable water supply services (effectiveness). Therefore, qualification for effectiveness in the water sector becomes clear by observing the service delivery levels whilst efficiency is concerned with the most cost-effective option through minimisation of inputs used in the production of the water commodity.

3.3.3 Cost recovery

Gupta (2011 p. 2) has given three categories of cost recovery that are commonly used; "(a) operational cost recovery means that the revenues are at least equal to the operating expenses of providing a service; (b) full service cost recovery means that capital maintenance expenditure and costs of capital are also recovered: and (c) full environmental cost includes the external costs of a service, including any environmental damage". The traditional approach to cost recovery worldwide, uses the second category to imply full service cost recovery. This definition has been adopted for the study.

The water regulator in Zambia has designated the cost side of cost recovery as; "Full costs are defined as O&M costs plus finance costs, depreciation and any allowed provisions" (NWASCO, 2016 p. 12). These costs, form the denominator side of cost recovery. The other side of the ratio which is equivalent to the total income recouped from users would be taken to mean the *revenue actually* collected from water users as calculated by the Zambian regulator NWASCO. The measurement for total income recouped is measured by the bill collection rate in percentage terms and calculated as revenues collected divided by total water billed (NWASCO 2016). Cost recovery for water service providers entails that the total income recouped from users by the utility is equivalent or more than the expenditure for provision of the services (Gupta, 2011).

3.3.4 Water tariff

Gupta (2011 p.2) have described water tariff as "the set of prices, charges, and taxes used to generate revenue in water utilities". According to Mohayidin, Attari,et al., (2009), empirical findings from their research revealed that the revenue-recovery notion pricing mechanism was the widely used design. Water tariff therefore in this study are those rates assumed to follow the revenue- recovery principle which is inclined towards the covering of maintenance costs and the provision for capital maintenance costs.

3.3.5 Operational efficiency

Operational efficiency which is the focus of this study, takes the description under the perception of Cole (2004) that explains efficiency and effectiveness. Efficiency is thus taken as executing or operating in the most excellent manner with least waste of time and effort. Mbuvi (2012) has explained the variable clearly in terms of not just being able to obtain the highest output with the given resources (efficiency) but also being able to meet customer demands for quality and reliable water supply services (effectiveness). Therefore, qualification for effectiveness in the water sector becomes clear by observing the service delivery levels whilst efficiency is concerned with the most cost-effective option through minimisation of inputs used in the production of the water commodity.

Operational efficiency for this research will be defined as the management of "water losses, bill collection, and labour productivity" as proposed by Marin (2009. p. 4) and these three aspects will be considered as sub-variables.

3.3.5.1 Water losses

Water losses are commonly indicated by the non-revenue water rate (NRW). Mutikanga, et al (2011 p. 327), has said NRW "is the difference between system input volume and billed authorized consumption". In this study, water losses will include both physical and commercial

losses. Commercial losses will be indicated as “water theft, employee corruption and poor water metering practices” (Mutikanga, Sharma, et al., 2011 p. 327). Physical losses will incorporate all losses due to technical inefficiencies. Water losses will thus be synonymous with NRW and quantified in percentage terms.

3.3.5.2 Bill collections

Bill collection involves pursing payments of debts owed (Rao, 2016). The success of the utility in bill collection is therefore measured by the bill collection rate in percentage terms and calculated as revenues collected divided by total water billed. In this study, the critical components that affect bill collections that will be adopted include; swift distribution of bills, a dependable user database, acceptable payment facilities and a robust computerized database for users. Misra and Kingdom (2012) contend that human handling errors, commonly made through reading meters and billing errors should be eliminated in the billing process. The efficiency in bill collections in this study will be signalled by the above parameters.

3.3.5.3 Staff productivity

According to Freeman (2008 p. 5), staff productivity can be viewed as “the ratio between a volume measure of output (gross domestic product or gross value added) and a measure of input use (the total number of hours worked or total employment)”. The quantity measurement of outputs indicates the service output by the workforce whilst the “*input use*” indicates the period, determination and services within the labor force. Input labor “is measured either by the total number of hours worked of all persons employed or total employment (head count)” Freeman (2008 p. 5). In this study staff productivity will be measured by the following indicators; as a ratio of total number of customers connections and total employment, that is staff per 1000 connections; as staff costs as a ratio of operating costs; and also as staff expenditure in relation to total company expenses which will measure the percentage of labor costs on the cost structure pattern of the CU

Rowley and Redding, (2012) have described human resource as the collection of expertise, skills and intelligence. For the purposes of this study therefore, staff productivity indicators will also incorporate skill/knowledge and training and staff performance measurement.

3.3.6 Operationalization table

Table 1 below summarizes the transformation of the theories and variables, defined above, into measurable indicators.

Table 1:Operationalization of Variables

Operationalization of Variables				
Theory	**Variable**	**Sub-variable**	**Indicator**	**Data type**
Management theory	Operational efficiency	Water losses	Incidence of pipe bursts & transmission losses	Quantitative
			Type of Maintenance strategy in place	Qualitative
			Available O&M plans, sample work orders, inventories, Manuals,	Qualitative
			Frequency of meter inaccuracy complaints	Quantitative
			Occurrence of illegal connections	Quantitative
		Bill Collections	Type of bill collections strategy in place	Qualitative
			Barriers to collections strategies	Qualitative
			Opinion on reliability and accuracy of billing system	Qualitative

			Occurrence of data handling errors	Quantitative
		Staff productivity	Adequacy of customer/employee ratio	Quantitative
			Employee factors influencing staff costs	Qualitative
			Skills/knowledge/training	Qualitative
			Staff Performance Management System in place	Qualitative
Water pricing theory	Water Tariff		Adequacy of current tariff per m3	Quantitative
			Customer willingness to pay	Qualitative
			Barriers to cost reflective tariffs	Qualitative
	Cost recovery		Factors impeding approved budget implementation	Qualitative
			O&M cost drivers	Quantitative
			Business growth strategy	Quantitative

3.4 Research strategy and type

According to Yin (1994) one defining element for a research strategy is to understand the substance of the research question. In this study, the aim of the research is to explain the factors impeding cost recovery at LgWSC. Therefore, for this type of study an explanatory approach using a case study strategy was adopted to explain the how and why questions in the study.

A case study approach involves an intensive, all-inclusive research of a single or more aspects of a phenomenon being studied in a contemporary real-world setting (Merriam, 1998). Case study strategy is favored when researchers are interested in in depth analysis, new knowledge and interpretation. By focusing on situational factors characteristic in a specific study area, important issues are revealed in depth and therefore insights into the subject under study become much clearer. The case study approach therefore, is best suited for applied field research and can play a significant role in advancing the knowledge base of the issues of cost recovery in the water sector.

3.5 Data collection methods

Prior to the fieldwork which took place between 1st to 28th July 2017, a set of questionnaires were presented for inclusion as an additional data collection tool. The approval was granted and thus two data instruments where adopted for the study.

The research data collection method was mainly guided by a qualitative approach that was taken for the study. Both primary and secondary qualitative data was gathered on the unit of analysis. Qualitative data captures a multifaceted representation of the phenomenon under study. According to Creswell (2013), qualitative research involves bring together various forms of data as opposed to depending on a lone source of data. Primary data collection thus involved the use of both interviews and questionnaires. Therefore, the study involved analysing multiple viewpoints from management in their various disciplines and identifying the various dimensions of the situation through *interviews* which allowed for interaction with various informants, as well as, data across a spectrum of informants through the use of *questionnaires* which allowed for a broader viewpoint of the factors influencing cost recovery at LgWSC.

The study reviewed existing literature and legislation. The main data sources for secondary data included the existing institutional framework that governs the management of water utilities in developing countries including scholarly articles on the internet and any other

sources available. Document review included existing policies regarding the sector, annual financial reports, strategic plans, and performance agreements. Primary and secondary data was compared and contrasted for harmony or contradictions and these formed a useful basis for triangulation of data for the study.

3.6 Data collection instrument

Two main data collection tools were employed to obtain the primary data for the study; semi-structured interviews and closed questionnaires. The main supposition of taking this type of inquiry was that the blend of interviews and questionnaires would offer a much more complete understanding of the study problem than either research tool could provide (Creswell, 2013).

3.6.1 Interviews

The interviews were designed to provoke opinions and views from respondents. Semi-structured interviews allowed for divergence whilst remaining focused to the structure of questions and this was an efficient use of the researcher's time as it maintained some structure. An interview guide designed in line with the operationalisation table was sent to all respondents in advance to acquaint all respondents on the type of the research in as much as it did not bias or pre-empt respondents (see Annex 1). The interview questions were divided into five sections each under a theme variable where questions were in line with indicators for the variable included in the study.

The advantages of using the interviews was that it allowed the participants to provide an in-depth explanation and where possible, an historical account. The semi structured interviews allowed the researcher control over the line of questioning. The main limitation to this data collection method however was the fact that the researcher's direct contact might have biased the responses. In order to counter this dilemma, transparency in the research process was enhanced by documenting the whole research process whilst respondents were reassured on the confidentiality of all information gathered.

3.6.2 Questionnaires

This study also made use of questionnaires to allow the researcher to have a broader perception of the respondents' views on the various aspects of cost recovery. Questionnaires increased the respondents of the study and provided a basis for triangulating data from the interviews. Closed questions were used and were divided into seven sections; the background section, and six sections with indicators on each of the variables under study (see Annex 2). A five-point Likert scale format was used in the questionnaire (1-5). The employee's perception on understanding of cost recovery implementation was rated. (for example; 1-Strongly disagree, 2 – Disagree, 3 - Neutral, 4 – Agree, 5 - Strongly agree).

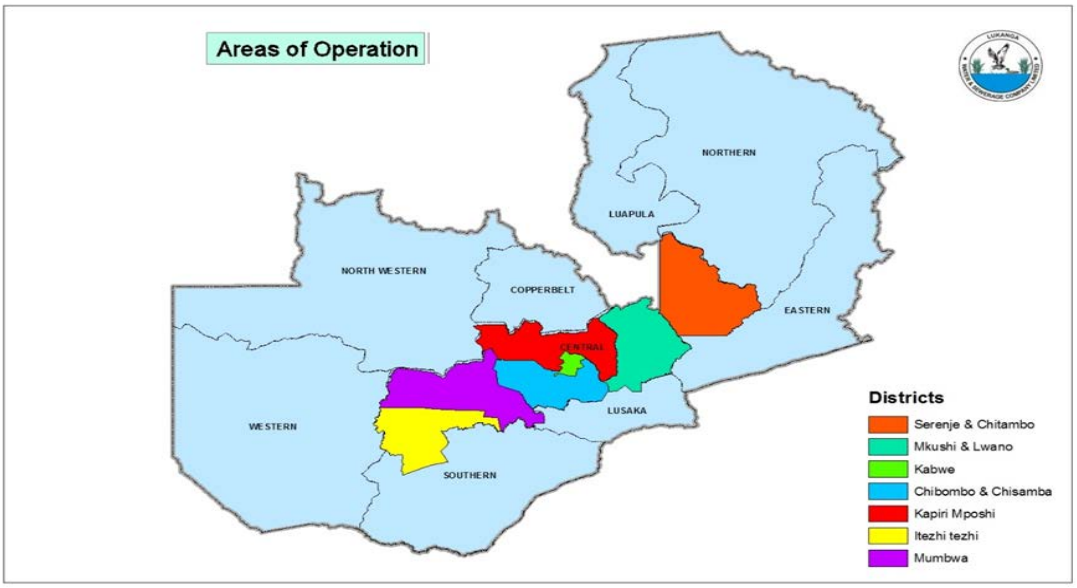
3.7 Unit of analysis

The unit of analysis in this study is Lukanga Water and Sewerage Company (LgWSC). It is a water utility established as a private enterprise to operate water infrastructure in the central province of Zambia. It is currently operating in ten districts which include, Kabwe, Kapiri Mposhi, Mkushi, Luano, Serenje, Chitambo, Chibombo ,Chisamba, Mumbwa and Itezhi-tezhi. LgWSC has in employment a total of number of 245 staff to manage operations in the seven centres across the province (see fig.3). The reason for selecting this unit of analysis is that the CU had attained a decade of operations since its establishment, a timeframe within which it was expected to achieve at least 100% operations and maintenance cost recovery in the sector.

The population for the study, comprised ***59 management and supervisory staff*** that operate in different departments and have a stake in the operations and management of LgWSC. There

are mainly four departments at LgWSC namely; Engineering, Finance, Human Resource and the Commercial &Business development departments.

Figure 3: Map of Zambia with LgWSC areas of operation



3.8 Sample size and selection

For interviews, a purposive sampling was applied in the selection of the respondents. The selected informants included key decision makers in each of the four departments and external subject experts to allow for in depth extraction of information and a broad spectrum of views on the phenomenon under study. A total of eight interviews were conducted; six internal and two external respondents. (see table 2). Three candidates from the initial list failed to avail themselves despite several appointments made. The two external recommendations were considered well placed and acquainted with the scope of the study. These were; one subject expert from NWASCO- the water regulator who was considered to be appropriate to the research and one respondent selected on the ground of their valuable experience which they attained after previously working at LgWSC as Technical Manager.

The sample size for questionnaires was based on a population of all the 59-management staff within LgWSC. To achieve a confidence interval of 95%, a sample of 32 respondents was selected. This would allow for an error margin of 5% (Sapsford, 2007). A stratified random sample was further drawn by using three main levels of management of the CU; senior, middle and low. From the list of the 59-management staff a ratio of 1:2:1 from the three levels of management was found to be representative of each section. Thus, a random sample of respondents was selected from each category.

Table 2:Profile of respondents intendent and actually interviewed.

	POSITION	DEPARTMENT	HIERACHY	NO.
1	Maintenance Manager	Engineering	Senior Manager	1
2	Business development and Commercial Manager	Commercial	Senior Manager	1
3	HR & Administration Manager	Human Resource	Senior Manager	1
4	Management Accountant	Finance	Middle Management	1
	~~Credit Controller~~	~~Finance~~	~~Middle Management~~	
5	District Manager	Operations	Middle Management	1
6	Engineer	Engineering	Middle Management	1
	~~New connections supervisor~~	~~Operations~~	~~Supervisory~~	
	~~Senior Commercial supervisor~~	~~Commercial~~	~~Supervisory~~	
7	Technical Manager	Ex-employee	Senior Manager	1
8	Commercial and Financial Officer	NWASCO	Senior Management	1
	Total			8

3.9 Data quality: validity, reliability and objectivity

The major setback of case study approach is that the results cannot be generalized. Solitary cases offer limited basis for generalizing as they depend on a single case examination making it problematic to reach a generalising conclusion (Yin, 1994).

Further, key informant interviews also bring along several biases as they constituted subjective observations of the selected interviewees. To enhance and supplement the validity of the collected interview data from the respondents, the interviewees' opinions were triangulated with questionnaires and document review of existing policies regarding the sector, annual financial reports, strategic plans, and performance agreements as well as scholarly articles on the internet and any other sources available.

The other limitation that was encountered was that although the in-depth analysis of a phenomenon is desirable for case studies, the time and budget allocation required for this undertaking was limited. The problem of bias that comes with the subjectivity of the researcher, was countered by ensuring the internal validity and reliability of the whole body of decisions involved in carrying out the design was enhanced. Internal validity was enhanced through use of a cross spectrum of informants from each department and documentation of the research process. The study made use of ethical considerations and the confidentiality of its respondents. The participants were informed of the way data and their identity would be handled.

3.10 Data analysis methods

Interviews

The interview findings were mainly interpretative focusing on describing and understanding the context of the problem. The data analysis tool used the Atlas Ti version 8 which involved initially transcribing the interviews and then coding them in line with the indicators outlined in the operationalization Table 2. Codes where created to capture the indicators of both the dependent variable (cost recovery) and the independent variables (operational efficiency and water tariffs). The codes were further clustered into groups according to the conceptual framework of the study.

Co-occurrence (Cooc) tables were generated to search for patterns between codes under the different themes of the study. The Cooc tables enabled the researcher to see links of quotations between single codes (Contreras, 2011). Through exploring of the quotations, the researcher endeavoured to understand the actual meanings behind their links. To explore patterns using more than a single code, a query tool was used. In this enquiry, codes were clustered for easy analysis and then quotations that were used concurrently were retrieved by the aid of the operators "AND"/ "OR" in the Atlas Ti analysis tool. Clustering had a vital part in the process of analysis as it facilitated the identification of the type of patterns between the two clusters of variables and these enabled the researcher to have a clearer view of the relations between the groups of codes. Outputs were then generated for each group and compared. The data was then used for the final analysis to answer the research questions.

Questionnaires

The questionnaires, were examined in detail by the use of the Statistical Package for Social Science (SPSS). The data was collected and entered into the SPSS software for analysis. Descriptive statistical analysis that is, the means and frequencies were conducted to show the survey sample characters as well as to to triangulate responses from the interviews and these provided valuable insight to the researcher. A multiple regression analysis that involved a review of management perception on the connection and interrelatedness of the variables in the study further enabled the researcher to have an indication of their prioritisation of factors that influence cost recovery and provided a statistical indication of the extent to which the independent variable was perceived to influence cost recovery.

To test for the correlation on the variable under study, Pearson correlation tests were carried out. The strength of association was denoted by the correlation coefficient (r) which takes values from (-1) to (+1) to show correlation between the variables. An (r) value away from zero revealed a stronger correlation between the variables. A multiple regression test was then carried out. A test of significance for the correlation and regression tests were noted to indicate the statistical significance. A P-value of less than 0.5 was deemed acceptable.

Secondary Data

Existing literature was used to analyse findings of the study. The numerical data gathered from company documents was used to compare and augment the primary data gathered.

Chapter 4: Research Findings

4.1 Introduction

The chapter summarizes the research findings based on the data collection outlined in the previous chapter. A synopsis of the research case is given in section (4.2) outlining the unit of analysis and the focus of the study. The characteristics of the respondents is given in (4.3). Presentation and analysis of data regarding each sub research question will be done in section (4.4), where data from both the interviews and questionnaires is analysed. Finally the statistical results were summarized and discussed according to the theoretical review and conceptual framework of the study in 4.5.

4.2 Description of the case

The unit of analysis in this study is Lukanga Water and Sewerage Company (LgWSC). It is one of the eleven water utilities in Zambia created after the enactment of sector reforms in Zambia. LgWSC is a State-Owned Enterprise (SOE) in which six local authorities in central province wholly own the shares of the company. The Water Utility was created after a successful build and transfer agreement with African Development Bank (ADB)and the Government of Zambia. The water utility was given the mandate and responsibility to provide WSS services to areas falling under the six local authorities in the province. From the commencement of operations, the Zambian water utilities have been striving to attain full cost recovery.

The selection of this unit of analysis is that the CU has attained a decade of operations since its establishment, a timeframe within which it is expected to achieve at least 100% operations and maintenance cost recovery in the sector. It is in view of this that a research was undertaken to investigate how operational efficiency in water loss and bill collections management and staff productivity on the one hand and the current water tariffs on the other, influence the cost recovery ability of LgWSC.

4.3 Description of the sample

Interviews

A purposive sampling was applied in the selection of the respondents for interviews from both within and outside the utility. The selected informants from within the utility included key decision makers from each department and two external subject experts. This was to allow for in depth extraction of information and a broad spectrum of views on the phenomenon under study. The final list of interviewed responds comprised of eight respondents; four senior managers; two middle management level and two external candidates; one a former employee of the company and the other a subject expert from the national water regulator. (See Table 3)

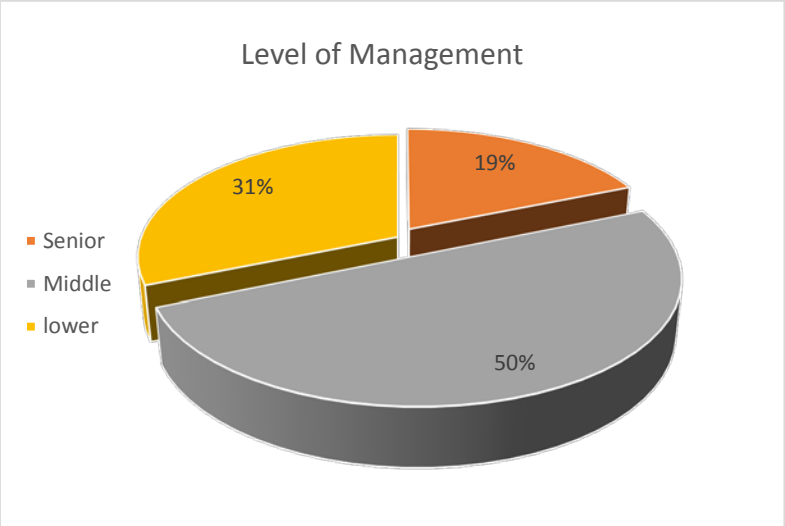
Table 3: Profile of Interview respondents

Department	Level of Management	NO
Technical/HR/Commercial & Business Development	Senior	4
Finance/Branch Manager	Middle	2
Ex-employee	Former Technical Manager	1
Subject Expert	Commercial and Financial Officer (NWASCO)	1
		8

Questionnaires

For the questionnaires, the sample size was based on the population of the management staff at LgWSC of 59. A sample size of 32 respondents drawn from a stratified random sample categorized by level of management of the CU. The summary of the sample characteristic is illustrated in figure (4) below.

Figure 4:Survey results: Summary of the survey sample characteristics analysis



4.4 Presentation and analysis of data of research questions.

In this section data will be presented in line with the sub questions of the study and organised in line with the indicators under each sub question. The analysis in all sections will start with a summary of the main interview responses. The interview respondents will be denoted as D1 to D8 according to codes developed using Atlas Ti software. Thereafter, the relevant results from the questionnaires will be compared and contrasted with the interview responses. Secondary data gathered, shall be used to support the gathered findings for purposes of triangulation. A description of significant outcomes which are consistent with previous literature reviewed will be given at the end of each sub question analysis.

4.4.1 How do the current water tariffs affect cost recovery?

To answer the above sub question three indicators were used to establish the appropriateness of the existing tariff and their influence on cost recovery. These include; the adequacy of water tariffs, barriers to cost reflective tariffs and the customers willingness (see table 4).

Table 4: **Summary of interview responses sub-question 1**

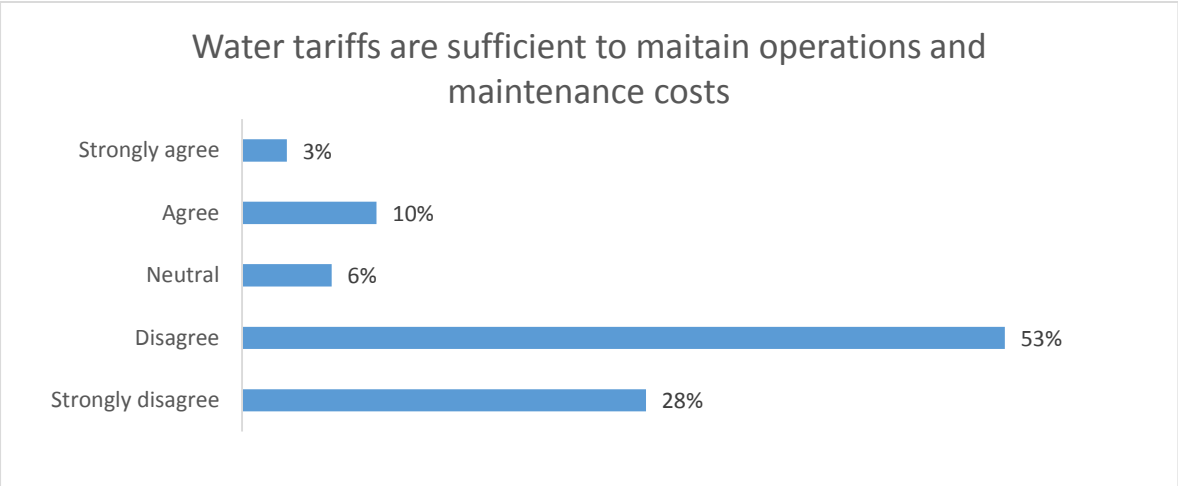
Indicator	Summary responses from interviews	Freq
Adequacy of current tariff/cost per m3 ratio	LgWSC has the lowest tariff in the sector in Zambia. Tariffs are inadequate for O&M costs - they do not reflect costs associated with operations	6
Customer willingness to pay	Tariff were generally affordable for customers – therefore customers did not have a problem with the cost of water, the challenge was when services offered were poor.	6
	Customers despite the low tariffs did not pay willingly, they have to coerced to do so by threatening them with a disconnection.	7

	Although no survey has been conducted in the province on willingness to pay; Surveys in other regions showed that water was not prioritised - people would rather spend on luxury rather than settling bills for water.	2
Barriers to cost reflective tariffs	"Water" is largely "considered a social good". This socialist background affected the payment culture – there is need for customer sensitisation; Water is political, Government wants everyone to afford it	5
	Lack of adherence to service level guarantees - failure to meet agreed service level conditionality; Unpredictable circumstances made tariff projections difficult.	5
	Water utility operates in a regulated environment -Utility has to get approval from regulator who ensures customers are not disadvantaged by having sudden huge tariff hikes – therefore you accept tariff even when they are not cost reflective	7
	Barriers to cost are two-fold; the first one addresses issues that border on policy matters that protect customers from being exploited; And the second one address the issue of the ability of the water utility to analyse its business environment in order to get the right revenue and cost projections - a wrong projection meant CU would be stuck with that tariff for three years. Failure to adhere to approved cost projections during tariff implementation adversely affected performance of CU	4

Adequacy of current water tariff

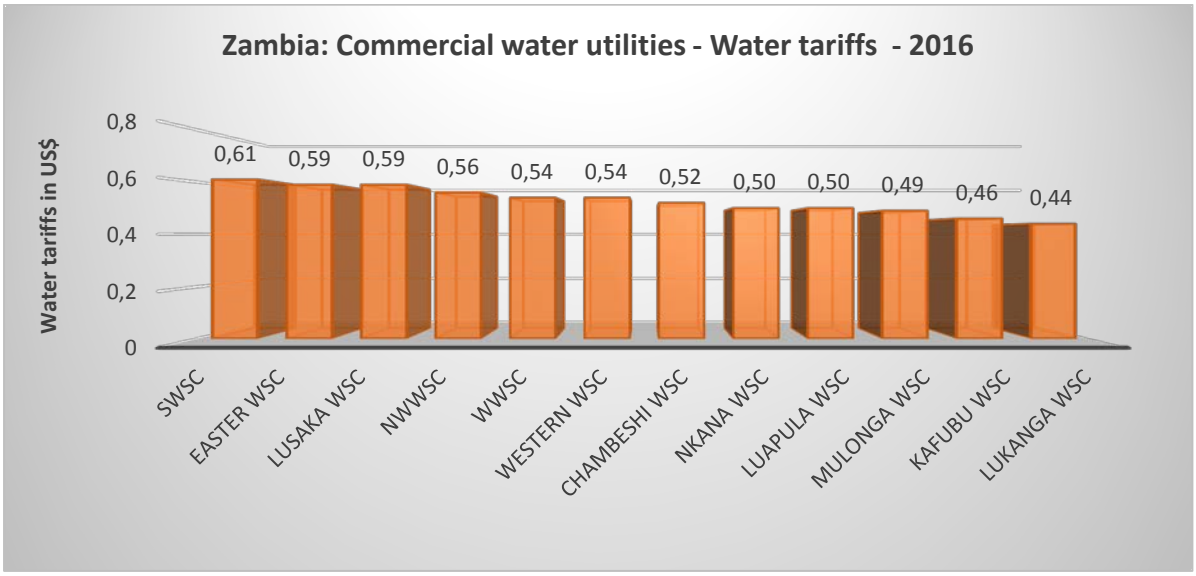
According to 6/8 interview respondents, the current water tariffs were not sufficient to cover O&M costs. Further, D4 indicated that LgWSC, currently had the lowest tariffs amongst the 11 water utilities in Zambia. The inadequacy of the water tariff was also resounded in the survey where a mean score of the responses was 2.06, with 81% of the respondents suggesting clearly that the respondents perceived the current tariffs to be insufficient to cover the O&M costs in full (see figure 5).

Figure 5: Survey results: Water tariff responses



A secondary data review on the prevailing water tariffs showed LgWSC had the lowest tariff in the sector. The water tariff benchmark rate for the Zambian water utilities for 2016 ranged from US$0.44/m3 to US$0.61/m3 (IBNet Tariff DB, 2016). Refer to Figure 6 below.

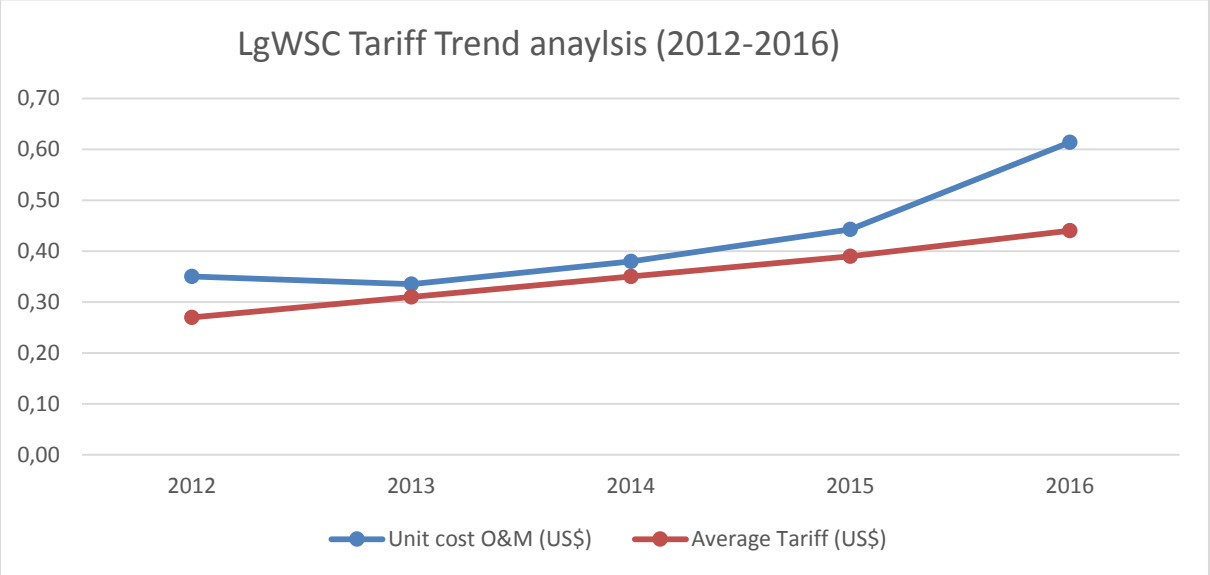
Figure 6: Zambia CU water tariff rates 2016



Source; IBNet Tariff DB (2017)

The Tariff trend analysis in Figure 7 below shows an analysis of the average tariff/m3 and the unit operating costs/m3. It compares the average tariff for water with the operational expense per unit of water consumed in the period 2012 to 2016. The analysis shows that although the tariff was gradually increasing it fell below the unit O&M/m3. For the utility to fully cover the costs, the tariff needed to be greater than or equal to the unit O&M cost/m3. If the pricing mechanism was the only factor influencing revenue, in 2016 for example, the tariff had to be equal to US$0.61 for the costs to be fully covered. LgWSC was thus operating at a deficit of US0.17/m3 with the 2016 tariff. The tariffs were therefore low in past five year and the unit tariff per cubic metre did not cover the unit O&M/m3 costs.

Figure 7:LgWSC tariff Trend analysis



Source LgWSC MMS database

In the literature, Banerjee,Foster,et al (2010), addressed the question on whether tariffs adequately covered costs using the Africa Infrastructure Country Diagnostic study (AICD 2007). They indicated that the unit cost of water sold by African utilities of which Zambia was part of, ranged between $0.30/m3 in 2001 to $1.10/m3 in 2005. However, in order to cover

"operating maintenance and most investment needs in the face of *extreme* supply shortages" a tariff above US1.00/m3 would be needed (Banerjee, Foster, et al., 2010 p. 12). In practice however, applying an above US$1.00m3 cost reflective tariff with the low levels of household budgets would make it difficult for most households to access water and would affect the collections of the water utilities. At LgWSC, the 2016 Annual Technical report, indicated that the company experienced rampant and increased load shading and irregular electricity supply from the electricity company, ZESCO, which resulted in shortages of water supply. The utility was thus forced to ration water supply throughout its districts of operation. In the face of such challenges applying a tariff of US$0.44 was inadequate to meet cost recovery.

In summary, the current US$0.44 is evidently not adequate to cover fully the O&M costs of the utility. Further, the Tariff trend analysis in Figure 6 has shown that in the past five years the average tariffs were not adequate to cover O&M costs/m3 at LgWSC. Dagdeviren (2008) has said the Zambian tariffs are some of the lowest in comparison with other countries in the region and expressed doubt on ambitions of cost recovery in Zambia, as the lowest water charges in low cost housing were found to be unaffordable for a notable percentage of the population in the country. LgWSC with the lowest tariffs in the country currently, could thus not be expected to achieve full O&M cost recovery.

Barriers to cost reflective tariffs

In terms of barriers to cost reflective tariffs, two notable issues emerged; the first one addressed issues that border on policy matters that protect customers from being exploited, and the second one address the issue of the ability of the water utility to analyse its business environment in order to get the right revenue and cost projections as well as the ability for the utility to perform according to the agreed service level standards.

On the first issue respondent D7 indicated that when preparing the tariff proposals, it was always in their mind that the regulator had a threshold within which any increment could be effected in any particular period, therefore they tended to be conservative. He stated that; "*instead of putting the actual proper costing as it were. you are a little bit reserved…*" (D7:41). This was also iterated by D3 who indicated that increase in tariffs did not always go according to the way the utility wanted to. Literature reviewed indicates that the Water Supply and Sanitation service provision is monopolistic in nature (World Bank, 1994). It is this monopolistic characteristic of the commercial utilities which justifies the regulation of water tariffs. Providers would tend to exploit customers with high charges and would have no incentives to extend services in low cost locations where it is uneconomical to supply water (NWASCO, 2014). The external respondent D8, a subject expert indicated that as a matter of policy, cost reflectiveness was tailored to be gradual towards full cost recovery with a view to making the sector self-financing. Water utilities therefore could not just move from one end to the other at once.

On the second issue, respondent D2 indicated that LgWSC had substantial independence for proposing tariff, however the challenge was that tariff approval was tied to performance. If the water utility did not meet the required conditions the regulator could not approve the tariffs. D2 said the conditionality was in place to ensure inefficiencies by the water utilities where not transferred to the customers. This view was also iterated by respondent D4 who stated that when a utility failed to meet its service level guarantee it was difficult for the regulator to honour its tariff increase requests. D8 also iterated that water utilities had substantial autonomy in proposing tariffs however, tariff proposals largely depended on how the management of the utility fared with the agreed conditionality as well as how they analysed their business environment. Therefore, not only were CUs expected to meet the service level conditionality

but were required to have some level of competence in the tariff process setting. Expressed in the respondents own words;

"*Having said that, we do offer sufficient guidance - every year we take them through the tariff model and we try and train them on how they can to do this but the outcome of the proposal that they make is totally their responsibility, so they take ownership of the proposal that they do and when they make the proposal we cannot change it for them, we can only approve or disapprove what they have proposed but the intention really is to progress towards cost coverage and since that is the underlying objective of all this because eventually we want the sector to be self-financing so that is the objective."* (D8:25 (2246:2880))

In summary, the findings on barriers to cost were two-fold; the first one addresses issues that border on policy matters that protect customers from being exploited and the second one address the issue of the ability of the water utility to analyse its business environment in order to get the right revenue projections. These barriers have an influence on the tariff that is finally implemented by the CU. Failure to propose appropriate tariff over the years may have further delayed the achievement of cost recovery in the company. Respondent 8 mentioned for example that the outcome of the proposals made by the CU was totally their responsibility.

Willingness to pay by customers

From the frequency table, 6/8 respondents were of the view that the current tariff was affordable. D7 however said that most of the people in the peri-urban areas, which to a large extent was the biggest network LgWSC was serving, said that the tariff was not affordable. He however, explained that when the costing was fully clarified to customers they appreciated and were more willing to pay.

Table 4 also showed that 7/8 of the interviewees said that generally, most customers were not willing pay their bills as they usually had to be coerced to do so by threatening them with disconnections. D5 explained that generally the payment pattern from customers was poor and alluded to the fact that coercion was the only way to get customers to pay their bills. D3 indicated that they had observed a trend where when disconnections were not done, collections would tip down. The observation on the customers unwillingness to pay bills was consistent with the response from D8 who said that although no survey has been conducted in the province on the willingness of customers to pay by the water regulator, surveys in other regions had shown that water was not prioritised, people would rather spend on luxury than pay for water. D2 indicated that most customers still had the socialist background of water being a social good. However, he indicated that with more customer sensitisation the response from customers indicated some improvement. Further that, when services were good, customers where more like to responded well, poor services inevitably resulted in a poor payment culture.

In summary, the findings on willingness to pay were that most customers were not willing to pay their bills this was on line with previous surveys done in other regions (Dagdeviren, 2008). This was evident from the fact that they had to be coerced to pay by threating them with disconnections. Consistent with the interview respondents, Dagdeviren (2008) in his study found that despite the low tariff in Zambia, customers in low cost area found the water tariffs to be unaffordable. It could also explain why there was general apathy towards paying for bills. However, in the absence of a study of the payment behaviour pattern in the province it is difficult to say anything conclusively on the affordability and willingness to pay of customers this area.

4.4.2 How does operational efficiency in water loss, bill collection and staff productivity affect cost recovery at LgWSC?

To answer the above sub question twelve indicators clustered into the three sub variables were used. The sub variables, water losses, bill collection and staff productivity are used to explain how operational efficiency affects cost recovery at LgWSC. Each sub variable will be analysed separately.

4.4.2.1 Water losses

Four indicators where used to formulate actual questions on how water losses affect cost recovery. Table 5 summarised the interview responses on water losses:

Table 5: Summary of interview responses sub-question 2;water losses

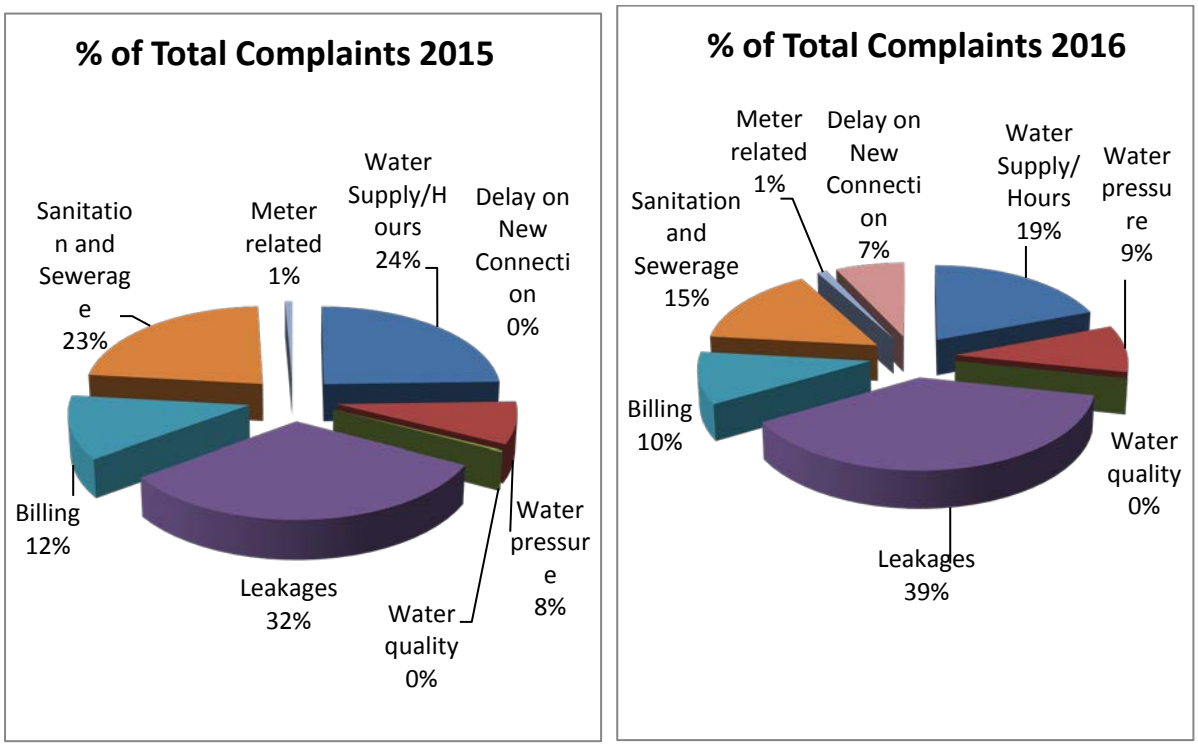
Sub-variable	Indicator	Summary of responses from interviews	Freq.
Water losses	Water leakages	Old network which needs an overhaul-the pipe network is old. Bursts and leaks on a daily basis due to an old pipe network; Physical losses alone account for approximately 20-25% of the water loses in the company	7
		A lot of pipes and valves still buried and are not captured on our as-built drawings; unidentified water pipelines could be reason for high NRW	2
		Lack of leak repair materials due to cashflow problems;	6
		Impact of high NRW is exaggerates energy and chemical cost	5
	Operational strategies	Meter management policy only approved in 2014 - not yet fully operational -lack of implementation of meter management has resulted in commercial losses as some have not been replaced and are under registering;	2
		Main strategy on maintenance of leakages is worst first	5
	Meter inaccuracies	Current metering at 75%; 60% of the meters are 10 years old and some are under registering; Stuck meters; Company still procuring meters to replace	5
	Illegal connections	Rampant illegal use of water despite incidences where offenders have been prosecuted	4
		An adhoc inspectorate team carries out inspections at customer premises	7

Water leakages

From the interviews 7/7 respondents said that the pipe network was old. The old pipe network was attributed to the frequent bursts and leaks the company was experiencing. Two respondents said that in addition to the old pipe network, a lot of pipes and valves were not captured on the as-built drawings. This was further worsened by the fact that some pipes were buried and unidentified. 6/7 respondents further indicated that, there was generally a shortage of leak repair materials due to cashflow problems which further exacerbated the physical losses because in most cases some leakages took long to be resolved as the repair materials were not always readily available.

A review of secondary data showed that, most of the complaints received during the past two years (2015 &2016) were water leakages that accounted for between 32-39% of the complaints received. These were followed by water supply related complaints of between 19-25%, whilst sanitation complaints were 15-23% and water pressure complaints at 8%. Physical water complaints thus accounted for slightly over 80% of the utility challenges in both years whilst the remaining 20% was attributed to apparent losses (figure 8).

Figure 8: LgWSC Categories of customer complaints – (2015-2016)

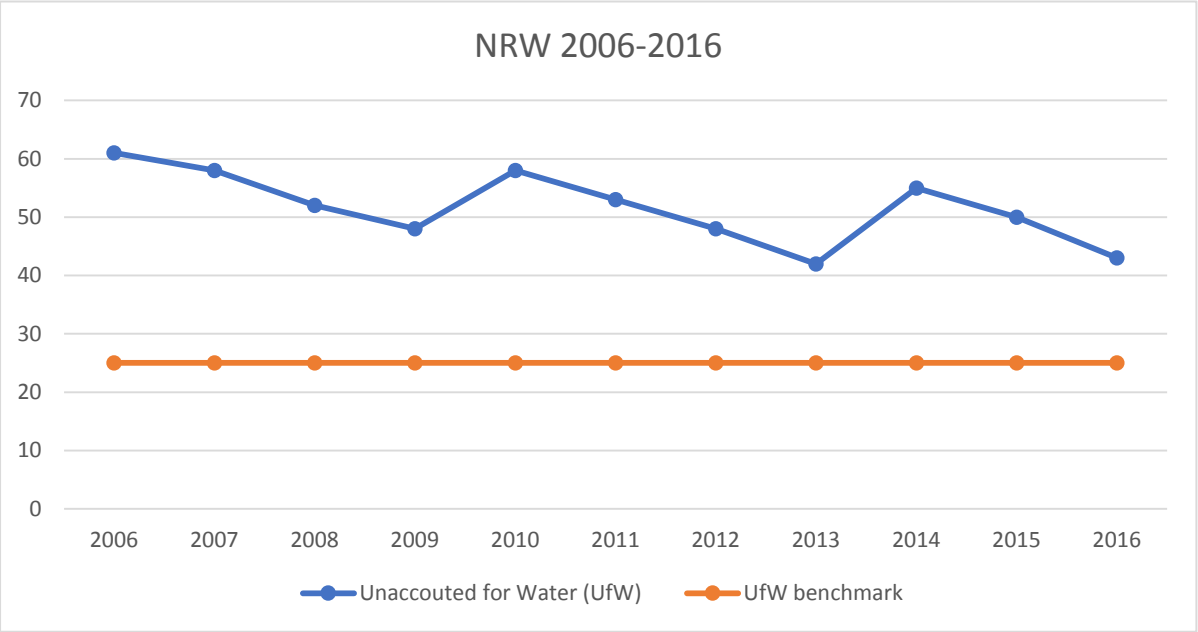


Source: LgWSC 2016 Commercial department reports

In terms of quantification, D7 indicated that although physical losses at LgWSC could not be accurately established due to lack of a clear leakage index system, physical losses alone accounted for 20-25% of the water losses. From the secondary data reviewed, water losses at LgWSC have been high since the inception of the company. Figure 9 below shows water loss trends, which depicted how NRW had been over the past decade. The graph, showed how gradually the NRW declined from 61% in 2006 to 43% in 2016. Even at a high rate of 43%, the NRW at LgWSC was actually better than the average performance of utilities in the Zambian water sector (NWASCO, 2017). Nonetheless NRW at LgWSC was below the sector benchmark of 25%, throughout the period. The high level of NRW is not unique to LgWSC, Makaya and Hensel (2014) have said majority of urban water systems in developing countries have been characterised by substantial losses both in monetary terms and physical terms.

5/7 respondent stated that impact of the high NRW was artificially exaggerating the energy and chemical costs and was part of the reason why the cost recovery ratio was below the target. These observations are consistent with what Makaya and Hensel (2014) said that, water losses adversely affects the cost structure in service providers in developing nations and it is the high operational costs that result in many of these countries operating at technically low-level efficiencies compared to other service providers in developed nations. Further they have said that this results in serious negative effects on the financial viability of the utilities.

Figure 9: LgWSC Water losses trend (2006-2016)



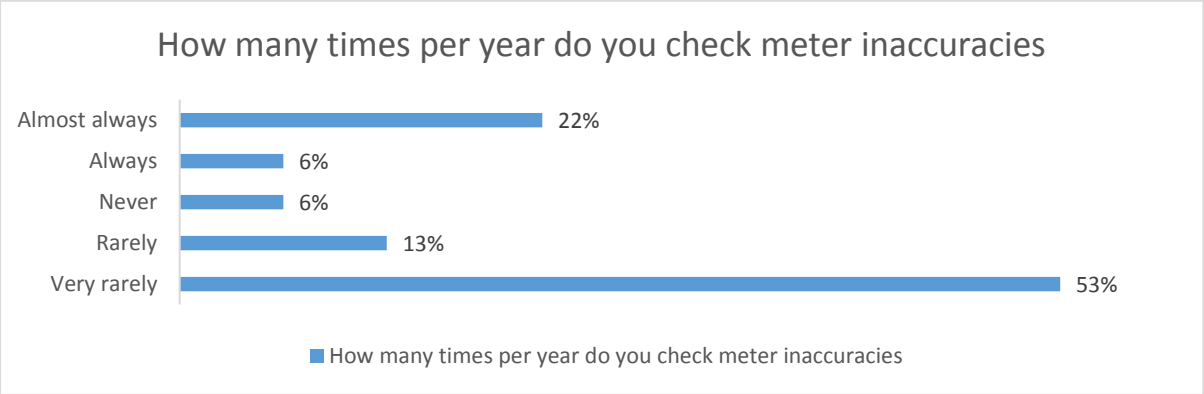
Source: NWASCO sector reports (2006-2016)

Operational strategies and meter inaccuracies

In reference to operational strategies in place, 2/7 respondents echoed the concern that although a meter management policy was in place and was an approved policy guideline since 2014, it was not yet fully operational and lacked practical implementation on the ground. This observation is consistent with the results from the pilot survey which showed 72% of the respondents said that meter inaccuracies were rarely checked (see Figure 10 below). A fully operational meter management policy would ensure consistent programme of meter checking. This is a material concern considering that 5/8 of the interviewed respondent mentioned that close to 60% of the meters at LgWSC were almost ten years old. Ironically, the customer complaints reported in figure 8 above, showed that meter related complaints accounted for only 1% of the total complaints in the customer complaint database. It is probable that when meters were under registering, it was highly unlikely that customers would complain as the billing was in their favour. D3 related the lack of implementation of the meter management policy to the commercial losses resulting from the under registering of some of the old meters that had not yet been replaced. Further that, in instances when meters were tested they were mostly found to be under-registering, and also that when they carried out an analysis of the billing it was found that in one area called Lukanga, the highest consumption was 10 cubic meter in a month which was said to be an unrealistic consumption pattern in that given area.

In the same vein, literature reviewed showed that Mutikanga, Sharma, et al., (2011 p.331) in study of a water utility in Kampala reported that "*test results from 90 loggings and 250 test-bench results on various meter sizes had an overall weighted meter accuracy for domestic meters (0–15 years) measured at 78% or at weighted meter error of (-)22%. This meant that meters in this study were under registering consumption by 22%, resulting in significant revenue loss to the utility*". The study concluded that commercial utilities experienced apparent losses because of poor water metering practices. The study showed that these elements contribute to significant revenue losses for water providers and ultimately brought in distortions of the reality of consumption data needed for various management decisions in water utilities.

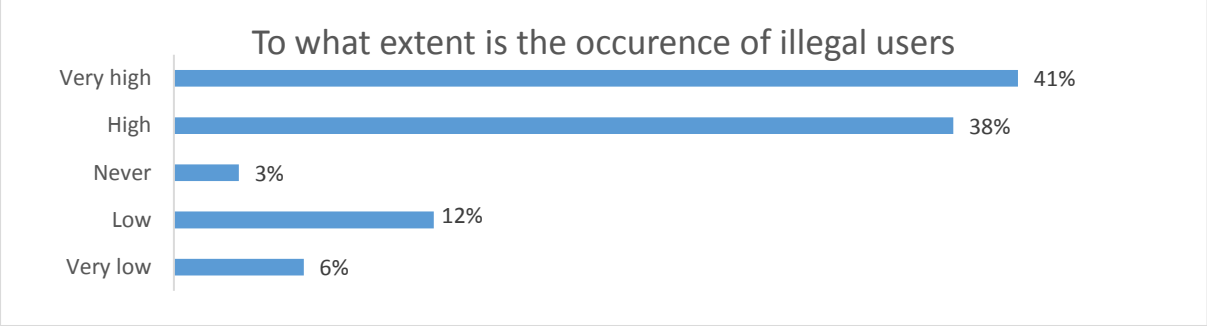
Figure 10: Survey results: Meter inaccuracy monitoring



Illegal use of water.

4/7 respondents said that illegal activities on water were rampant in the utility. This was also the general view of respondents in the pilot survey (see Figure11 below). 79% of the respondents said that the occurrence of illegal activities was high. The responses had a mean score of 3.94 meaning that respondents perceived the occurrence of illegal on average as high. 7/7 mentioned that an ad hoc inspectorate team was comprised from time to time to inspect illegal activities. Interview respondent D4 however, bemoaned the fact that despite the high level of illegal activities the utility, an improvised inspectorate team was being used to handle these cases, this was against the best practice within the sector to have a permanent section to handle such activities effectively. Mutikanga, Sharma, et al., (2011) have indicated in their study that illegal use of water which is a problem seemingly associated with developing nations, is also prevalent in water companies of the developed world. They cited USA's city of Philadelphia where annual investigations of customer accounts revealed illegal practices in various forms. Further they cited a case; “in the Brazil's city of Sao Paulo under Sao Paulo Water and Sanitation Company (SABESP), where out of 63 508 water fraud inspections carried out in the Central Business Unit, 7% fraud cases were confirmed…” (Mutikanga, Sharma, et al., 2011 p.329). They have said identifying illegal use of water activities, can be a thought-provoking task that calls for proactive tactics that can be done through inquiries of outlier tendencies in customer consumption patterns which are exhibited through zero or negative consumptions, and could be countered with recruitment of illegal use informers as the case was in Kampala.

Figure 11: Survey results: Occurrence of illegal use of water



From the indications of the interviews and the questionnaire, it is apparent that meter inaccuracies plus the rampant unauthorized water usage were notable components of commercial losses at LgWSC. In summary, therefore, despite the visible improvement in the management of NRW over the years which has seen the NRW to reduce from 62% in 2006 to 43% in 2016, it is still evident that water losses both physical and commercial, have adversely

affected the performance of the water utility and has negatively affected its ability to attain 100% O&M cost recovery. With NRW of 43% as at close of 2016, the water company could only account for 47% of the water production, the other 43% was lost between the physical and commercial losses. The implication on production costs is that the CU was spending the equivalent 43% more on water that was not contributing any income to the organisation. These inflated water production costs exerted unwarranted negative effects on the ability of the CU to cover its costs fully.

Further, in line with this conclusion, the statistical results of the regression conducted revealed that water losses with a standardised coefficient beta of 0.525 was the highest predictor of cost recovery (see section 4.5, Fig 19 below).

4.4.2.2 Bill collections

Four indicators where used to formulate actual questions on how bill collections affect cost recovery. Table 6 below, summarises the interview responses on bill collections;

Table 6: Summary of interview responses sub question 2; bill collections

Sub-variable	Indicator	Summary of responses from interviews	Freq.
Bill collections	Bill collections strategy	Bulk messaging system; Flexible payment plans; Special payment arrangement through the banks; Xapit; Swiping machines at Shoprite; Talks with mobile providers; Customer engagement;	4
		Mega mass disconnections - however due to political interference disconnections are selective- Certain institutions cannot be disconnected.	5
	Barriers to collections strategies	Poor payment culture with some categories of customers Poor services lead to poor collections Customers must be coerced to pay. Alternative sources of water	6
	Reliability and accuracy of billing system	Reliable billing system – no major issues	7
	Data handling errors	Billing ratio is on average 98%; Systems errors very minimal; Common billing errors human related but generally within acceptable limits	5

Bill collections strategy

The main collection strategies at LgWSC according to respondent 3 included starting firstly with the Bulk Messaging System (BMS) where customers were reminded to pay their bill on phone before the actual bill was delivered. Secondly when the bills were overdue withdrawals of service was implemented. The third option allowed for customers to opt to be on flexible payment plans. Special payment arrangements through the banks like the Xapit bill payment arrangements of the Zambia National Corporation Bank were also in place. In addition to these strategies, D6 indicated that all management staff joined the operations staff in a mega mass disconnections operation scheduled every two weeks in a month which was preceded by concrete engagements with customers in all categories. All the customers that did not respond

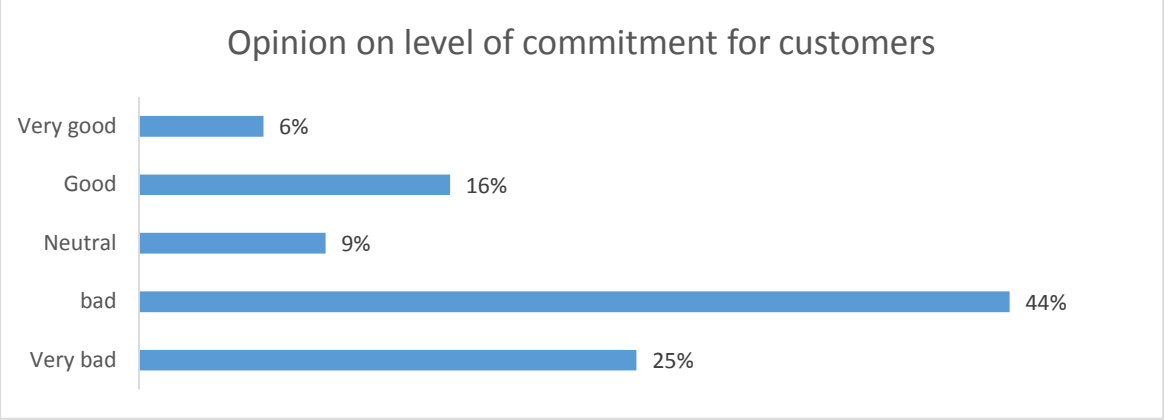
were disconnected during the mass disconnection period. 5/7 respondents mentioned that the mass disconnections were the most effective strategy which forced customers to pay their bills. Overtime, it had been observed that whenever the mass disconnections started, there was a sharp spike in collections. Although this strategy was in line with the strategy suggested by Misra and Kingdom (2012) to conform with measures to avoid the buildup of huge unpaid arrears, by ensuring disconnection and reconnection were carried out, this strategy had limitations at LgWSC especially when customers found alternative water supply sources. Respondent D5 indicated that because of the high water table in the province customers resorted to other water sources as private boreholes and wells. It became a big problem for the company to recover debt accrued from such customers.

Blore et al (2004) have alternatively suggested drip-feeding payments (e.g. prepayment meters) to improve collection levels from poorer customers. The argument here is that it is better to embrace phased payments to mitigate short-term variations in income than to incur costs for bad debt recovery packages. Consistent with this strategy, in the LgWSC case, a review of literature showed that the financial statements for year ending 2015 reported a capital injection of ZMK 4,068,019.95 (US$448,486.27). This was for a pilot prepaid meter project in which the company procured 1372 domestic prepaid meters and 23 prepaid bulk meters to boost the collections for the CU. Management was hopeful that the investment would yield results.

Barriers to collections strategies

The level of commitment to customers was generally reported to be poor. 6/7 interview respondents alluded to the fact that customers had to be coerced to pay and mega mass disconnections were the most effective way for collections. Additionally, 5/7 respondent reported that although the strategy of mass disconnections was working for most domestic customers it was not effective for institutions due to political interference. This resulted in selective disconnections as certain institutions could not be disconnected. They mentioned that this impacted badly on collections and constituted the main reason for poor collections in the CU. D5 also mentioned that the other major hindrance to bill collections was high prevalence of alternative sources of water. Customers were comfortable with the alternative sources as long they perceived no health repercussions to those sources of water and did not bother to settle arrears that they had accumulated on the piped water supply before. A review of responses from the questionnaires on the perceived level of commitment of customers towards paying bills showed that 69% of the respondents said that customers were not committed to paying their bills. The mean score was 2.34 implying a large number of customers was perceived not to be committed to paying their bills. (Figure 12 below). This could explain why it took drastic measures of disconnection for them to be coerced to pay for bills

Figure 12: Survey results - level of commitment to pay bill

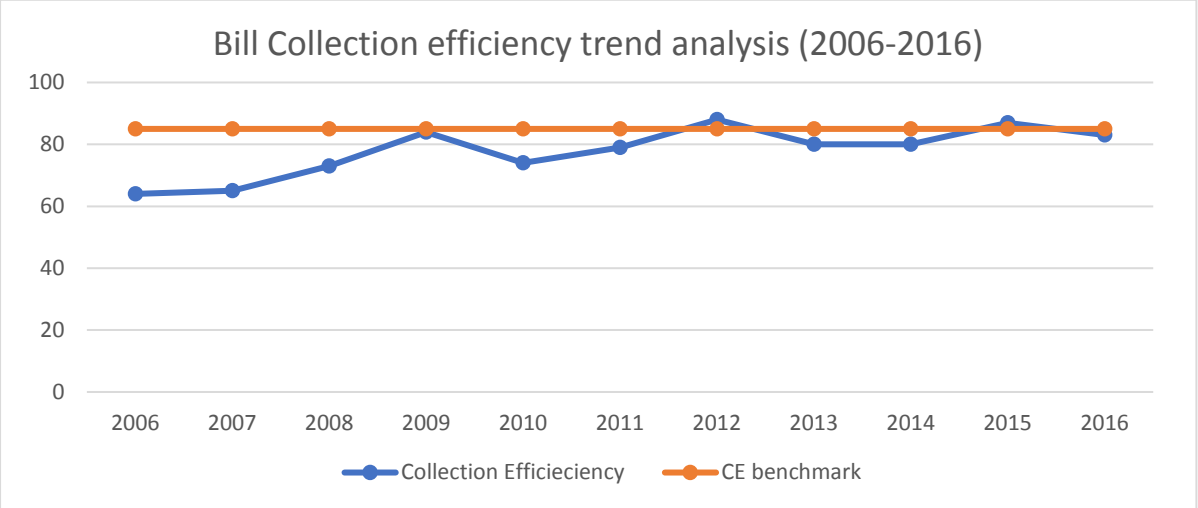


In summary, the study revealed two main barriers to collection strategies; the strategy of mass disconnections was said to be ineffective for some institutions due to political interference. This resulted in selective disconnections as certain institutions could not be disconnectioned. In the literature, Misra and Kingdom (2012) had suggested as good practice for water providers to pay attention to clients that comprised a greater portion of arrears. However, amongst the water sector challenges outlined in the NWASCO (2017) sector report for Zambian water utilities was the low collections, particularly from Government institutions which in the case of LgWSC constituted about 48% of the debt owed to the utility.

The other barrier was the high prevalence of alternative sources of water. This was consistent with the findings of a study of willingness to pay in Sri lanka, where it was found that although poverty and costs were unquestionably key determinants of demand, the location and proximity to alternative water sources such as private dug-wells was a factor (Pattanayak, 2006). Inability to recover debt thus had an adverse impact on cost recovery for LgWSC.

Secondary data showed that generally collections were below the sector benchmark. Figure 13 below shows the collections trend for the company in the past ten years. Collections have clearly been below the sector benchmark almost for the entire decade of operations except in the three years; 2009, 2012 and 2015. A follow up on management revealed that the high peaks coincided with the time the company received payment of arrears by government institutions

Figure 13: LgWSC Bill collection trend analysis (2006-2016)



Source: NWASCO sector reports (2006-2016)

In summary, bill collections at LgWSC have been low. Low billing impacts negatively on the CU's ability to maintain its existing infrastructure and its need to extend services. Banarjee,Foster, et al (2010) has said in order for utilities to maintain present and future networks on a sustainable basis they need to at least partly fund the investment from internally generated funds. Management at LgWSC in addressing low collections has put new measures in place such as the different modes of payments, and convenient facilities for payment (e.g. the Shoprite swiping machine), and the prepaid metering systems.

Reliability and accuracy of billing system and Data handling errors

According to 7/7 of the respondents, the billing system at LgWSC was reliable and no major issues had so far been experienced with the billing system. They all alluded to the fact that the occurrence of billing errors was within an acceptable ratio. The company records showed that the current billing ratio was at 98% confirming the position held by the respondents. Most of the errors that occurred were human error related such as typographical errors. In the literature, Agrawal (2008) emphasized the criticality of service providers in ensuring updated and robust computerized customer databases as these formed core mechanisms for successful bill management. It was said therefore, that successful billing management included; reliable customer databases, convenient facilities for customer payments and vigilance in curtailing malpractices. Although LgWSC seemed to be doing well on bill management and convenient facilities, the same could not be said on the curtailing of malpractices which as stated above was rampant in the company.

In the statistical analysis, bill collection was found to be highly correlated to water tariffs (see figure 14). This was not surprising because in reality both water tariff and bill collections affect the income side of cost recovery. Given the low tariff at LgWSC, the low collections further added pressure on the CU's ability to recover costs. This correlation however between these two independent variables, statistically is not desirable as the explanatory power and the significance of coefficients of the two-independent variable is divided up between the two variables explaining the same dependent variable cost recovery (Princeton University, 2007).

Figure 14: Pearson correlation between water tariff and bill collections

Correlations

		watertariff	billcollections
watertariff	Pearson Correlation	1	.800**
	Sig. (2-tailed)		.000
	N	32	32
billcollections	Pearson Correlation	.800**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

4.4.2.3 Staff productivity

Four indicators where used to formulate actual questions on how staff productivity affect cost recovery. Table 7 below, summarises the interview responses on staff productivity;

Table 7: Summary of interview responses sub-question 2; staff productivity

Indicator	Summary of responses from interviews	Freq.
Adequacy of customer/employee ratio	Adequate in most departments; some sections understaffed/overstaffed; It is an issue of productivity rather than numbers.	6
	Inherited old council employees resulting in poor staff productivity	7
Staff cost drivers	Overtime due aged personnel inherited from the council;	4
	Top heavy management and high administrative, medical and Insurance costs	2

	In the past CU experienced high staff turnover due to the unattractive conditions of service	1
Skills/knowledge/training	Good HR policy on capacity building however, it is not structured to allow for continuous development training especially in maintenance operations	5
Staff Performance Management System	Robust PMS in place since 2015 that compliments capacity building to enhance staff productivity	7

Adequacy of customer employee ratio

6/7 interviewed respondents were agreed that the current customer employee ratio was adequate. Nonetheless, all the respondents bemoaned the fact that the inherited council employees were unproductive. The general view was that although the staff numbers were within the acceptable level, what was important to address was the issue of productivity. LgWSC had taken over some council employees who were now mostly above 55 years old - their productivity was therefore definitely not up to par. The company because of this was forced to hire causal labour to ensure certain jobs were carried out on time. D6 on the other hand, cited the sanitation section as being over staffed and claimed personnel needed to be deployed to other sections whilst D7 was of the view that more numbers were needed for some sections in the technical department to operate effectively.

The document review showed that, in the Zambian water sector, the benchmark for staff productivity that has been adopted since 2013 is the measure of staff cost in relation to the billing and collections as opposed to the use of employee per thousand connections commonly used(NWASCO, 2017). This measure is still consistent with OECD (2009) definition of labor productivity that considers the use of staff cost as a percentage of O&M costs. The current sector bench mark for Zambian water utilities is at a ratio of 0.54. Since, 2013, LgWSC staff productivity ratio was higher than the benchmark. In 2016 for example, LgWSC was at 0.69 (NWASCO, 2017). Therefore, LgWSC was operating at worse than the acceptable average benchmark. This implied that staff costs were higher than the acceptable level of 0.54

Staff cost drivers

Overtime was identified as a cost driver of staff costs, 4/7 respondents associated overtime cost to resulting from efforts to make up for the low productivity from the aged personnel from the council. D6 attribute overtime to an attitude problem that management was working on. The other staff cost driver identified in the past year was associated with a high labour turnover that had resulted from the unattractive conditions of service. The high labour turnover was countered with improving the conditions of service for senior members of staff and the subsequent high level recruitment. 3/7 respondent alluded to the top-heavy management costs coupled with the insurance and medical costs as being the cost drivers to staff costs. The staff cost driver indicator was used to identify factors that were driving the labour cost up. Rowley and Redding, (2012) have described human resource as the collection of expertise, skills and intelligence and have cautioned that most failures in Africa on water resources management can be attributed to the absence of trained staff and inappropriate management staff. Recruitment of qualified personnel therefore remains a good practice for water resource management but is at odds with cost recovery in the short run.

Skills/knowledge/training and the Performance Management system(PMS)

5/7 respondents said LgWSC had a good HR policy on capacity building, however they said there was need to have it structured to allow for continuous development training especially in maintenance operations. Further all the seven respondents alluded to the fact that there was a robust PMS in place since 2015 that complimented capacity building to enhance staff productivity. D6 explained that the PMS was used to monitor and manage staff productivity and was also being used as a training needs assessment tool. Consistent with what Rowley and Redding (2012) have suggested, training and development forms a core aspect in human resource management at LgWSC. The expectation is that it will ultimately induce staff productivity.

In the literature reviewed, in order to maximize organizational effectiveness, utility managers need to harness the human potential by investing firstly in qualified and competent staff and providing appropriate training and development. Haslinda (2009) has said for organisations to be effective staff must be appropriately deployed and distributed and should be allocated tasks they are capable of doing. The author argues human resources comprise the organization's greatest assets needed to support operations. Individual capabilities of staff and their potential needs to be exploited for staff productivity to be achieved. In conclusion, however this investment cost although justified, is at odds with cost recovery targets at LgWSC in the short run.

4.4.3 What other operational factors affect cost recovery at LgWSC?

To answer the above sub question three indicators where used to find out what other factors affects cost recovery at LgWSC. Table 8 below, summarises the interview responses on other operating factors;

Table 8: Summary of interview responses sub-question 3

Variable	Indicator	Summary of responses from interview	Frequency
Cost recovery	Budget Implementation	Maintenance expenditure compromised due to poor cashflow resulting in poor maintenance of network	5
		High energy cost and chemical costs due to high levels of NRW offset the budget.	5
		Misplaced priorities; Poor cost containment measures on administrative expenditure	2
	O&M cost drivers	Personnel, energy, chemicals and depreciation costs	8
	Business growth strategy	Lack of focus on business growth	4
		Poor response to new service connections requests.	1
	Autonomy of operations	Substantial independence in operations of CU but not in proposing cost reflective tariffs	5
		Limited independence at corporate level governance (D8:18).	1

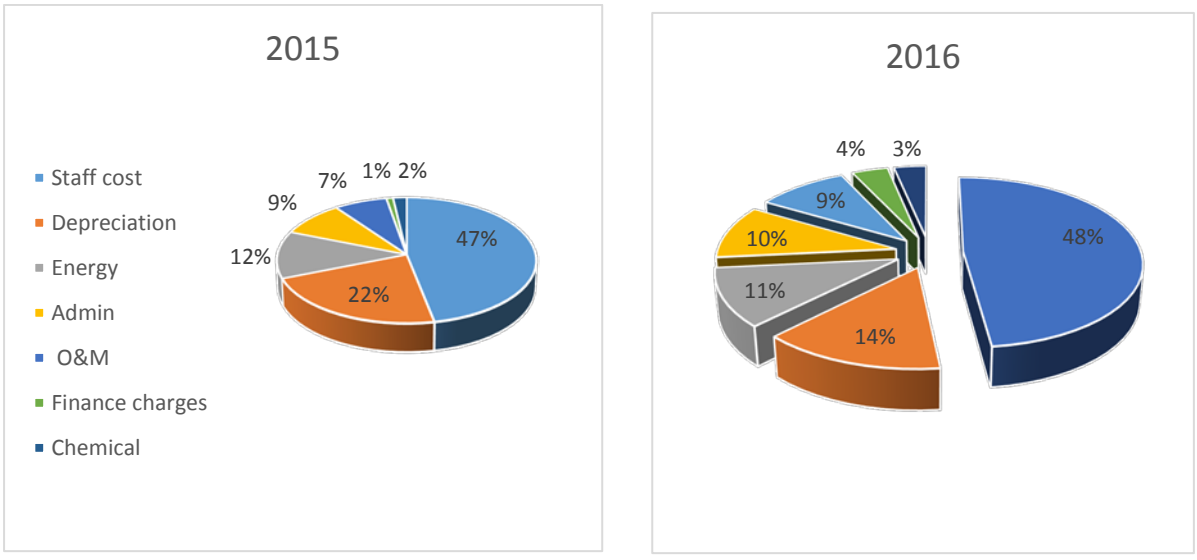
Budget Implementation and Cost structure

In terms of budget implementation, 5/8 respondent said maintenance expenditure was compromised due to poor cashflow. This meant that some maintenance works had to be

postponed and in some extreme cases were left unattended for a long time and this impacted negatively on NRW (see photograph 1 in appendix 4). D2 mentioned that maintenance cost always looked low because materials were not being bought and the required repairs were not being done. Further, 5/8 respondents alluded to the fact that high energy and chemical costs were a result of high levels of NRW which were increasing costs for the utility. Budgetary pressure due to cashflow challenges was thus prompting deferral of some maintenance costs at LgWSC. Commenting on budget implementation, D8 indicated that misplaced priorities and poor cost containment measures on administrative expenditure were some of the reasons that the utility was facing challenges in covering its costs.

A review of the LgWSC cost structure (see Figure 15 below) showed that maintenance costs were only ranging between 7-9% in the past two years compared to the labour costs that were at 47% and 48% in the two years reviewed. The cost structure also revealed that on average 79.5 of the recurring costs which include staff costs, depreciation and finance charges and energy accounted on average 79.5% of the operating costs. This was consistent with what Hukka and Katko (2003) said that WSS operations have high fixed costs that often reach limits of about 80 percent of operating expenses. Further, respondent D2 bemoaned the failure to implement preventive maintenance due to cashflow challenges. This concern is in line with what Esmaili (2012) who has advocated against that deferral of operating expenditures which were most likely to deteriorate the state of infrastructure and make it more costly to restore the assets in the long run.

Figure 15: LgWSC Cost structure (2015-2016)



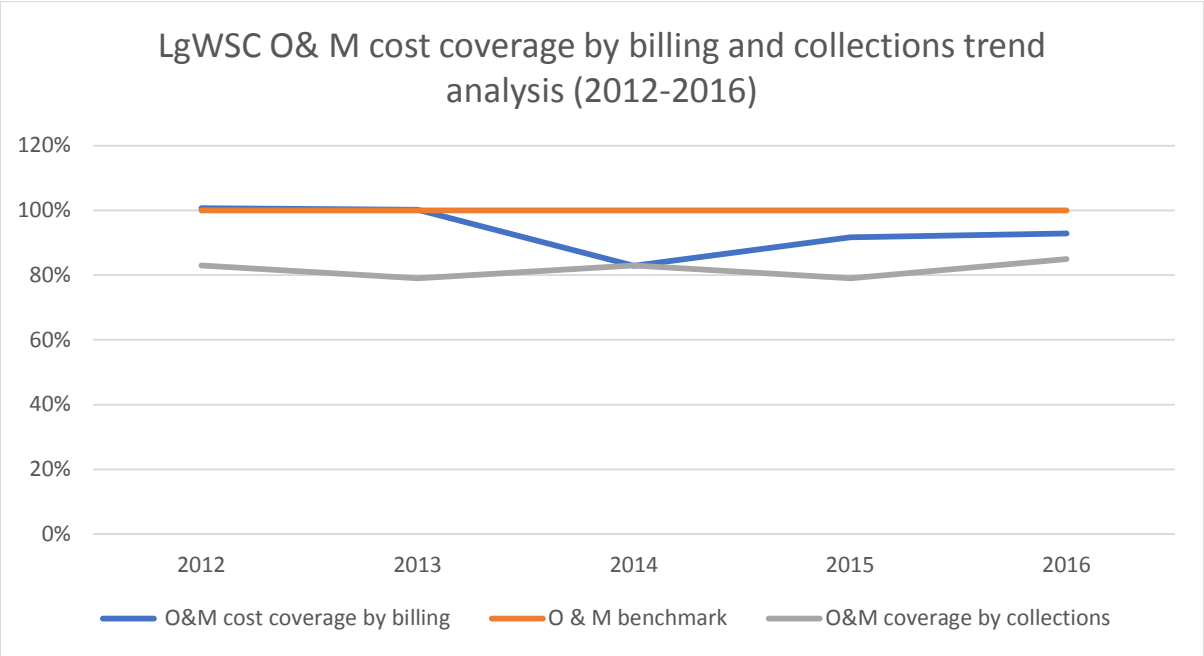
Source; LgWSC Financial reports(2015-2016)

On cost containment, respondent D8, the subject expert, explained that one of the factors that hindered utilities from recovering costs was their lack of cost containment. Lack of budget discipline on major costs within the control of management such as personnel and administration costs was a factor that utilities overlooked. Cost containment in this case becomes a critical objective in the areas where management has control such as the personnel and administrative costs for achievement of cost recovery in the sector.

Secondary data, as depicted in Figure 16 below shows how O&M cost recovery by billing had been lower than O&M cost by collections. Both O&M costs by billing and by collections were below the sector benchmark during this period, indicating the inability of the CU revenue both by billing and collections to cover the targeted costs. The graph further indicates the gap in income available for O&M costs (cashflow deficit)# and is in line with what respondent D2

said that maintenance cost always looked low because materials were not being bought and the required repairs were not being done due to cashflow limitations. Evidently collections adversely affected the CU's ability to implement its budgeted expenditure.

Figure 16: LgWSC O&M cost coverage by billing &collections trend analysis (2006-2016)



Source; LgWSC MMS database (2012-2016)

O&M cost drivers

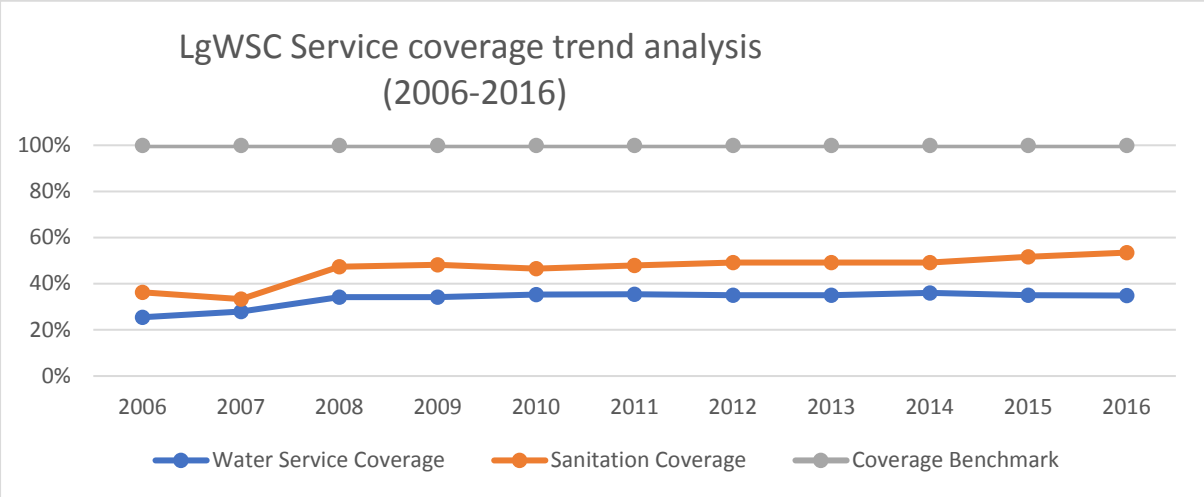
Apart from staff costs the next largest components of O&M costs at LgWSC, was depreciation. Refer to Figure 15. D1 explained that depreciation cost in 2015 escalated after the final assets were transferred by a statutory instrument that required all water infrastructure to be handed to the water utility by the municipalities in the province. Depreciation is a required expenditure in the cost recovery principle. The "Full costs are defined as O&M costs plus finance costs, depreciation and any allowed provisions" (NWASCO, 2016 p. 12). The inclusion of the depreciation cost in O&M costs is in line with the generally accepted capital maintenance approach of the World Bank that; "focuses on measuring the expenditure needed to maintain assets at their current level of serviceability" (World bank (2006 p.79) . Although cost containment cannot be said to be relevant for depreciation costs, it is evident operating costs for water utilities are high, therefore CUs must source for revenues to cover its high capital maintenance costs. In a study, Hukka and Katko (2003) have said that delivering WSS services is an extremely capital-intensive undertaking. Huge investments, which extend over decades are required. Financing and investments in water utilities are thus still required to supplement user fees.

Business growth

D8 mentioned that LgWSC in general was not performing well on service extensions and cited the poor response to new connections requests as a major hindrance to business growth. Given that water utilities are capital intensive businesses, they depend on economies of scale to have a reasonable price mechanism (Kasoma-Mbilima, 2011). An increased customer base implies a bigger income base for the water utilities and higher likelihood for the utility to be able to cover its high operating costs. Service coverage thus, is a significant factor that influences cost recovery. A review of the service coverage for LgWSC showed that both the water and sanitation coverage were way below the 100% benchmark (see figure 17). Although the

company has been slowly increasing its database the pace has not been as expected. In its 2016 Annual report, LgWSC has cited the technical challenges that include encroachments into LgWSC wellfields and other properties coupled with the poor planning of some townships which has made it very challenging to maintain and extend service provision to un-serviced areas.

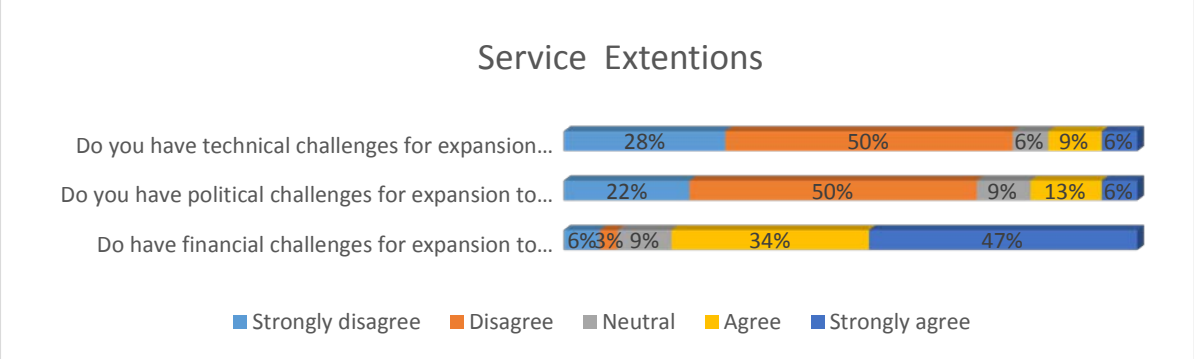
Figure 17: LgWSC Service coverage trend analysis



Source; NWASCO sector reports (2006-2016)

Further, D7 attributed cashflow challenges to the lack of growth in service extensions. This was consistent with the general perception from the survey. The results from Figure 18 show that 81% responses attributed financial challenges to barriers on service expansions for the CU and this was at a mean score of 4.13 revealing that respondents perceived financial challenges to service as a major issue for business growth. 72% ruled out political interference in the expansion of service extensions with a response mean score of 2.16 implying there was minimal political interference in this area; 78% thought there were no technical challenges in executing service extensions and the responses had a mean score of 2.16 showing that technical challenges for installing new connections were minimal (see figure 18). Evidently financial challenges where hampering the extension of services at LgWSC. Lack of finance and high dependence on support from cooperating partners for investment funding has been cited as a common issue in developing countries. (Kasoma-Mbilima, 2011)

Figure 18: Survey results on Service Extensions



Autonomy of operations

5/8 of the interviewed respondents said that LgWSC enjoyed substantial independence in the operations of the company. This perception was amplified in the survey as stated above where 72% of the respondents ruled out political interference in service connections. D8

however, said in terms of corporate level governance, most water utilities had limited independence. In summary, the other factors affecting cost recovery at LgWSC include; the low service coverage and the lack of finance and investment injections for service extensions.

4.5 Statistical results

To test for the correlation of the dependant and independent factors, the Pearson correlation tests was carried out. It revealed a strong correlation for the operational efficiency variables on the cost side, that is, water losses and staff productivity. The correlation on the income side; bill collection and the independent variable water tariff, was weak. Nonetheless, there is evidence to show that all the independent variables were correlated to the dependant variable cost recovery albeit on the weak side (refer to Table 9).

Table 9: Pearson correlation results extracted from SPSS results in Annex 3

Pearson correlation results; cost recovery with water tariff, water losses, bill collections and staff productivity	
	PV
Staff productivity	.825**
Water loss	.784**
Water tariff	.393*
Bill collections	.294*

* Correlation is significant at the 0.01 level (1-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

A test of significance for water tariff, water losses and staff productivity indicated that the variables were statistically significance with a P-value of less than 0.5, which is considered acceptable. (see figure 18) However bill collections were statistically insignificant with a PV of above 0.05. According to Princeton (2007) when independent variables are highly correlated, the coefficients of specific variables can turnout insignificant when the entire regression is significant, the reason is that extremely correlated independent variables tend to explain the identical changes of the dependent variable, therefore the explanatory power of coefficients and significance gets divided up amongst them. In this study, due to the high correlation at 0.800 between water tariffs and bill collections as shown in figure 13, the descriptive power in coefficients and significance was split between them. Thus, running the regression gave the bill collection an insignificant coefficient. The whole regression nonetheless was significant.

Figure 19: Coefficients table showing the statistical significance of variable

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	46.860	6.926		6.766	.000
	watertariff	1.098	.518	.263	2.118	.043
	waterloss	1.333	.237	.525	5.613	.000
	billcollections	-.686	.530	-.174	-1.293	.207
	Staffproductivity	1.245	.218	.505	5.720	.000

a. Dependent Variable: costrecovery

A multiple regression test was carried out which showed that the predictors; staff productivity, bill collection, water losses and water tariff influenced the dependant variable by an adjusted R square of 0.863. The adjusted R-squared of the regression in this study shows the portion change of cost recovery that is predicted by the operational factors and the water tariff factor. Therefore, it means that statistically the effect of the operational efficiency variables and water tariffs were explaining cost recovery by 86%. The other factors thus account for 14%. This is consistent with the findings in the study which have shown that both the operational efficiency and water tariffs have significantly contributed to the failure of the CU to attain the expected target of cost recovery.

Figure 20: Multiple regression results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.880	.863	5.17294

a. Predictors: (Constant), Staffproductivity, billcollections, waterloss, watertariff

b. Dependent Variable: costrecovery

Further, the standardised coefficients beta in figure 18 show that water losses at 0.525 was the highest. Standardized coefficients show how movements in predictor variables influences the relative position of those variables within the cluster. Therefore, using the values of the standardized coefficient beta, one is able to determine the predictor with a higher change impact. In this study therefore, water losses with the highest standardised coefficient beta of 0.525 had a higher impact on cost recovery, then followed by staff productivity at 0.505 and water tariff at 0.263. Indicatively therefore, operational efficiency variables had a higher relative change on the dependant variable cost recovery than water tariffs.

This statistic result is in line with what Gupta (2011) said that substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without unnecessarily raising water tariff rates. Efficiency gains that can be derived from saving water losses statistically for example would be higher than a unit gain in change of tariff. Given the sensitivity of changes in tariff prices and also the threating alternatives of water sources, it would be better for CUs to concentrate on improvements in operational efficiency rather than increasing water tariffs.

Mbuzi (2012) has indicated that studies on efficiency and effectiveness particularly in the context of African WSS sector, have not been widely researched in earlier studies. More studies based on monetary effects would therefore be beneficial to the sector than statistical analysis of management opinions as this study has done in the limited time available.

Chapter 5: Conclusions and recommendations

The chapter presents conclusions and recommendations on the basis of findings of the study. It addresses the challenges that LgWSC encountered in the past decade of its existence in achieving 100% cost recovery on its operations and maintenance costs. Cost recovery is the expected sustainable long-term goal for water utilities in Zambia, However, this expectation is yet to be realised in most of the water utilities in Zambia.

The purpose for the study is to explain the factors that have led to the failure of the water utility to attain the expected target of cost recovery. A case study methodology was taken with the aim of reviewing in depth two major factors; operational efficiency and water tariffs to explain the possible reasons of how each of the two factors can be used to understand the failure to attain the expected target of cost recovery at LgWSC. Operational efficiency was measured using three main sub variables; water losses, bill collection and staff productivity and the prevailing water tariff during the period under review was considered.

In the WSS sector, operational efficiency is a vision sort and mandate given by most stake holders. It refers to the success in achieving organizational targets at a minimum cost and is measured by the degree to which the organization optimizes its available resources. The intended outcome of commercialization reforms introduced across most African countries, utilities was for the pursuit of achieving efficiency and effectiveness in resource allocation and utilisation aimed at achieving cost recovery and improved access to water (Dagdeviren, 2008). Most governments, especially in the developing countries, could no longer support the colossal waste and inefficiency of the public sector, the agenda of privatisation and commercialisation was thus established to address the management of the public sector (Kalejaiye, Adebayo, et al., 2013). The NWP of Zambia in its 4th principle set "achievement of full cost recovery for the water supply and sanitation services (capital recovery, operation and maintenance) through user charges in the long run" (Republic of Zambia, 1994 p. 28). This was to be done through cumulative increase of user charges and through escalating efficiency in operations

To address the key research question of the study: *"To what extent does the influence of operational efficiency and water tariff explain the failure to attain the expected target of cost recovery at Lukanga Water and Sewerage Company?"*, three sub research questions were each addressed separately before the final conclusion was arrived at.

How do the current water tariffs affect cost recovery at LgWSC?

The business model used for LgWSC, like other water utilities is predominantly the user financed model where the revenue flow is obtained from user fees of customers connected to the water and sewerage network. The financing of CU is therefore highly dependent on water tariffs. Water pricing theories have been an important means by which CUs have endeavoured not just to improve water use efficiency but also to achieve cost recovery (Massarutto (2007).

The findings in this research from both primary and secondary data have shown that the current tariff at US$0.44/m3 was basically low and inadequate to cover the O&M costs at 100% at LgWSC. Given that the operating cost per unit was at US$0.61/m3 in 2016 for example, it meant that the CU was underfinanced by US$0.17/m3 . Therefore, in order to cover O&M costs at 100% the CU would need a tariff of not less than US$0.61/m3. Further, the study showed that within the Zambian water sector, LgWSC had the lowest tariff in the sector. The damaging long-term effect is that consumers end up having limited and poor-quality water services as the service provider is unable to invest and expand water service coverage. The situation is worsened by the fact that there are some inherent inefficiencies in operations that would render cost recovery in the immediate future to be delayed. Inadequate water tariffs therefore not only

adversely affected the current operations of the company but further reduced its capacity to retain funds for infrastructure investments.

The study has shown that low tariffs have led to low billing and consequently poor cashflows which have further added budgetary pressures on the CU. This has led it to defer some expenditures on operations and maintenance. Esmaili (2012) has said deferring expenditures on maintenance impacts negatively on asset management capabilities of utilities which further leads to inefficient functioning of those assets. This vicious cycle is bound to continue if the real problem of funding is not addressed.

In order to cover O&M costs adequately, it is important that barriers to cost reflective tariffs are eliminated. In the study, barriers to an efficient pricing system were two-fold. The first one addressed issues that border on policy matters that protect customers from being exploited; the absence of market competition has necessitated the role of regulation. The regulation of the sector was set to ensure inefficiencies by the water utilities where not transferred to the customers. Service providers would tend to exploit customers with high charges and would have no incentives to extend services in low cost locations where it was uneconomical to supply water (NWASCO, 2014). The ability for the utility to perform according to the agreed service level standards was thus a critical issue in the determination of the tariff. The second one addressed the issue of the ability of the water utility to analyse its business environment in order to get the right revenue and cost projections. The Zambian water tariff setting follows a cost-plus approach that utilises an increasing block tariff system. Water utilities are expected to make accurate predictions of economic indicators in order to arrive at the correct tariff proposals for the subsequent tariff period. Failure to make accurate predictions of future operating conditions is one barrier to a cost reflective tariff which ultimately delays the capacity for the CU to reach required targets of cost recovery thresholds.

The regulator's expectation for utilities in terms of funding is that eventually the utility must operate autonomously through a good pricing mechanism. However, the EEA, (2013), has said that water prices on their own, are unlikely to achieve full cost recovery through the water pricing mechanism, but are nonetheless critical to communicating vividly that safe water being a specially processed commodity ought to be used more efficiently. Focusing on tariff increases, in the face of operational inefficiencies and the inability to grow the service coverage, will only add unwarranted pressures to the few customers currently sustaining the water utilities.

How does operational efficiency in water loss, bill collection and staff productivity affect cost recovery at LgWSC?

The general scenario of the water utility is that it exhibited very high inefficiencies on both the income and cost side of operations. Inefficiencies on the cost side were exhibited in two ways; firstly, in the water losses both in physical terms and through commercial losses and secondly in the high operational costs particularly staff costs. On the income side, the inefficiencies were exhibited in the low collections particularly affected by non-payment of some of its major consumers. Therefore, the high operational costs coupled with low collection at below 85% restricted business growth and made difficult for the CU to attain the target cost recovery. The salient finds are summarised below.

Water losses and Cost recovery

Water leakages - Due to having generally an old pipe network, LgWSC was dealing with frequent bursts and leaks. This was further exacerbated by the fact that some pipes were still buried and unidentified. The shortage of leak repair materials due to cashflow problems further adversely affected physical losses because in most cases some leakages took long to be

resolved as the repair materials were not always readily available. In terms of quantification, physical losses at LgWSC could not be accurately established due to lack of a clear leakage index system, nonetheless an estimate of between 23-25% of the company's water losses were attributed to physical losses whilst the remaining 18-20% was attributed to apparent losses. Makaya and Hensel (2014) have said majority of urban water systems in developing countries have been characterised by substantial losses both in monetary terms and physical terms and what is lacking in most of the third world countries is the ability to accurately quantify both their physical and commercial losses. The impact of these losses was exhibited through the high operational costs which has resulted in the CU operating at technically low efficiency levels.

Operational strategies and meter inaccuracies - The main finding was that at LgWSC, the meter management policy lacked practical implementation on the ground. This was exhibited by the rare monitoring of meter inaccuracies on the ground. Close to 60% of the meters at LgWSC were slightly over ten years old. The lack of implementation of the meter management policy was a possible factor that resulted in the commercial losses subsequent to some of the old meter under registering. Mutikanga, Sharma, et al., (2011) in a study conducted in Kampala Uganda concluded that commercial utilities experienced apparent losses because of poor water metering practices. Metering inaccuracies exhibited through the under registering of the old meters despite not being accurately quantified, were significant components of the apparent losses at LgWSC.

Illegal use of water - The study revealed that illegal activities were rampant in the utility. However, despite the fact that there were high levels of illegal activities, the utility only had an ad hoc inspectorate team to handle such cases. Mutikanga, Sharma, et al., (2011) indicated in their study that, although illegal use of water was a problem usually associated with developing nations, it was also prevalent in water companies of the developed world. They have said identifying illegal use of water activities, can be a thought-provoking task that calls for proactive tactics that can be done by inquiries of outlier tendencies in customer consumption patterns which are exhibited through zero or negative consumptions, and could be countered with recruitment of illegal use informers as the case was in Kampala. In the case of LgWSC despite the high occurrence of illegal activities the utility only had an ad hoc inspectorate team to handle the cases

In summary, water losses both in physical terms and through commercial losses significantly affected the ability of the CU to recover its costs. Consistent with this, the statistical results in the regression analysis conducted, revealed that water losses with a standardised coefficient beta of 0.525 was the highest predictor of cost recovery (see Chapter 4, Fig 18).

Bill collections and Cost recovery

The study revealed two main barriers to bill collections; firstly, the strategy of mass disconnections was not effective for some institutions due to political interference. This resulted in selective disconnections as certain institutions could not be disconnected. Misra and Kingdom (2012) have suggested as good practice for water providers to pay attention to customers that constitute a greater part of arrears. However, for LgWSC and other utilities in Zambia, the water sector challenge outlined in the NWASCO (2017) sector report was the low collections, particularly from the Government institutions.

The second barrier was the high prevalence of alternative sources of water. Although the mass disconnections were an effective strategy for most domestic customers, alternative sources of water posed a major threat for the company in terms of business growth and ability to recover accumulated debt. This is consistent with the findings of a survey on willingness to pay in Sri

lanka, where it was found that although poverty and costs were unquestionably key determinants of demand, the location and proximity to alternative water sources such as private dug-wells, was a factor (Pattanayak, 2006). LgWSC has thus accumulated huge debts which have impacted negatively on its cash flow. The inability to recover debt has in turn had an adverse impact on cost recovery.

In summary, therefore bill collections at LgWSC have been below the acceptable benchmark expected in the sector of 85% for the past decade, due to the various challenges outlined above. This has made it difficult to realise the required target of 100%.

Staff productivity and Cost recovery

The study revealed that staff costs accounted for the major part of the company cost structure. Overtime was identified as a cost driver of staff costs and it was associated with efforts to make up for the low productivity from the aged personnel from the council as well as the general attitude problem which management was still working on. The other cost driver was attributed to the need to retain qualified and competent staff to run the organisation. Rowley and Redding (2012) have suggested that indeed training and development forms a core aspect in human resource management that induces productivity, therefore, in order to maximize organizational effectiveness, utility managers need to harness the human potential by investing firstly in qualified and competent staff and providing appropriate training and development. However, this investment cost is at odds with cost recovery at LgWSC in the immediate term. Although this cost in future terms is an investment, it currently needs to be countered with focus on reducing water losses and increasing business growth to reduce the impact of the heavy fixed costs.

What other operational factors affect cost recovery at LgWSC?

Business growth- A review of the service coverage for LgWSC showed that both the water and sanitation coverage were way below the target benchmark. Cashflow challenges were attributed to the general poor response to new connections requests and this was cited as a major hindrance to business growth.

Given that water utilities are capital intensive businesses, they depend on economies of scale to have a reasonable price mechanism (Kasoma-Mbilima, 2011). An increased customer base implies a bigger income base for the water utilities and it increases the utility's ability to cover its high operating costs. Service coverage thus, had a significant influence on the ability for LgWSC to attain target cost recovery.

To what extent does the influence of operational efficiency and water tariff explain the failure to attain the expected target of cost recovery at Lukanga Water and Sewerage Company?

Full cost recovery of WSS by way of tariff charged on users is generally looked upon as the cornerstone of sustainable water provision (Massarutto, 2007). In the Zambian set up, the primary aim of the tariff system is to recover O&M costs whilst progressing towards full cost recovery. This has involved the gradual increase in tariffs. The utilities are expected within the short to medium term possibly ten years to cover operation costs, finance costs, depreciation and some allowable provisions (NWASCO, 2016).

However, as the findings of this study have shown this has not been the case for LgWSC. The study has shown that LgWSC had the lowest tariff in the sector. The unit of water tariff per cubic meter therefore was not able to cover the unit O&M cost/m3. This resulted in the

delayed achievement of 100% cost recovery at the end of ten years of its existence. The low tariffs had therefore negatively affected its ability to recover costs.

Further, the commercialisation reforms introduced in the water sector across many developing nations was in pursuit of achieving efficiency and effectiveness in resource allocation and utilisation (Chitonge, 2010). As demonstrated by the findings of this study, operational inefficiencies both on the cost side and revenue side of operations have been adversely influencing the utility's ability to recover 100% of its O&M. Inefficiencies on the cost side were exhibited in two ways; firstly, in the water losses both in physical terms and through commercial losses and secondly in the high operational costs particularly staff costs. On the income side, the inefficiencies were exhibited in the low collections particularly affected by non-payment of some of its major consumers. Therefore, the high operational costs coupled with low collection at below 85% restricted business growth and made it difficult for the CU to attain the targeted cost recovery. Further, the cashflow challenges mainly caused by the inability of the company's major customers to settle their debt obligations on time compromised the operations and maintenance activities thus threatening the sustenance of the company's assets.

In conclusion, from the findings of the study, it can be conclusively said that operational efficiency and water tariffs significantly influence the ability of the CU to attain the expected target of cost recovery. This conclusion is further amplified with the statistical results (based on opinions of management staff of LgWSC) that have shown that statistically operational efficiency denoted as water losses, bill collections and staff productivity combined with the effects of the water tariff explained the failure to recover cost by 86%. This means that the remaining 14% was explained by other factors. The study has shown that other factors such as low service connection and lack of business growth have also contributed to the failure to attain the set target.

The study has further indicated that operational efficiency had a bigger effect on cost recovery than water tariffs. Statistically, for example, the standardised coefficients beta for water losses and staff productivity were higher than that of the water tariffs. This meant that operational efficiency was a higher predictor of cost recovery. This finding was therefore in line with the view that substantial revenue potential is possible for service providers by merely putting in place effective measures to increase operational efficiency without necessarily raising water tariff rates (Gupta, 2011). Therefore, by having operational efficiency in the management of water losses, bill collections and labour productivity, substantial revenue gains could be achieved. Although water tariffs are the major source of revenue through the user fees, focusing on the water pricing mechanism only, will not yield the desired outcomes for the sector (EEA, 2013).

In reality however, the challenges prevalent in the water sector makes prioritisation of either of operational efficiency and water tariff unattainable especially when the water utility operate at less than an optimum number of customer to sustain the business operations. Utilities thus also need to define the optimum level of business growth in order to counter the effects of the high operating costs.

Recommendations

In terms of contribution to the academic body of knowledge, it is the researcher's view that full cost recovery as defined in the study is still a realistic option for the majority of third world countries. The contention however, lies in the definition of the timeframe within which

full cost recovery can be attained and what constitutes the full cost recovery definition. Full cost recovery must be viewed in terms of the stage of development of the utility or the country. Although the study does not fully address the practicability of how full cost recovery can be achieved, it does give an indication that even in the midst of the challenges third world countries face, recovery of costs using the commercialisation principles is attainable without necessarily privatising the water sector. Having said that however, the results of this study were not intended for generalisation, the findings may not be transferable to any other setting but is nonetheless appropriate for other entities operating in similar conditions as LgWSC

In terms of managerial implications, it is recommended that in order to increase the ability to recover costs, LgWSC should focus its priorities in ensuring that water losses and staff costs are minimised. Further, LgWSC must also determine the optimum number of service connections that will ensure attainment of cost recovery by taking advantage of economies of scale in the operations

Recommendations for future research

At both utility and sector level, as previously indicated, there have been no surveys conducted in central province on willingness and affordability to pay. Information available has mainly been from other regions which are economically and demographically different. It is suggested that further research is conducted on customer payment attitudes to help the utility reforecast its business options.

At the broader academic level, it is recommended that more research is invested on operational efficiency gains based on the actual monetary value that can accrue from pursuing operational efficiencies in water utilities. This study has only given indicatively, how efficiency gains derived from saving water losses would be higher than a unit gain in change of tariff.

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Annex 1: Interview Guide

Introduction:

My names are Nangoma T. Ng'andu. Thank you, Mr/Ms……., for accepting to be part of this interview session. I am carrying out a research on the influence of operational efficiency and water tariffs on cost recovery in the water sector. The study will be gaining your thoughts and opinion on five main aspects of the study; water losses, bill collections, staff productivity, water tariffs and cost recovery. The interview will take approximately 25 minutes. Please note that this questionnaire is being administered for academic purposes. The results will be used to improve the operating efficiency of water service providers and thereby, improving the welfare of customers in developing countries. The responses will be treated confidential and the names will be anonymous and only codes will be used for identification. Therefore, I would like to you to be as open as you can be in responding to the questions I am going to ask.

Do you agree: Yes…….. No……. Date:……

Identification number…….

Interview Guide developed for research (Semi – Structured)

	Interview questions	**Indicator**	**Means of verification**
	Water losses		
1	What is the performance of LgWSC distribution network in terms of system losses related to technical challenges?	Frequency of bursts & leakages on transmission & distribution lines/month (physical losses)	MMS reports
2	Could you tell me about what systems, tools or guidelines that are used to effectively manage the distribution network?	Available O&M Plans, work orders, inventories, manuals Actual O&M Plans	Sample work orders, inventories, Manuals
3	What sort of strategy does LgWSC employ in maintaining the distribution network?	Type of Maintenance strategy	Company Documents
4	Do you have a meter management strategy? What is your opinion on the current performance of meters	Frequency of meter inaccuracy complaints (commercial losses)	MMS reports
5	Is the occurrence of illegal use of water within an acceptable level? Briefly explain what are the measures taken by utility to reduce illegal connections?	Occurrence of illegal connections (commercial losses)	MMS reports
	Bill collections		

6	What is your opinion on the level of commitment of your customers to paying their water bills?	Collection to billing ratio	
7	To what extent are funds collected from the bills sent to customers?	Opinion on reliability of customer payments	Key Performance Indicators reports
8	What bill collections strategies are currently in use	Existence of bill collections strategy	Company reports
9	What is your opinion on the reliability and accuracy of the current billing system	Opinion on reliability and accuracy of billing system	MMS reports
10	Is the occurrence of billing errors within an acceptable level? Briefly explain what are the measures taken by utility to reduce billing errors?	Frequency of data handling errors/month	MMS reports
	Staff productivity		
11	What is your opinion on the adequacy of the current customer/employee ratio with regard to operations in general?	Current customer/employee ratio	Annual company reports
12	Is the benchmark on the customer/employee ratio set by the regulator on staff adequate for your operations.		Annual sector report
13	LgWSC staff costs have been said to be high. Could you explain to me what are the factors influencing staff costs and how this affects operating costs?	Employee factors influencing staff costs	Annual company reports
14	Do you have a staff performance management system where rewards are based on the achievement of certain targets and not across the board? Please explain	Staff Performance Management System in place	Copy of performance appraisal forms/ performance agreement sample
15	What is your policy on training and continuous and development? If so, how many staff undergo training related to operation and maintenance activities?	Skills/knowledge/training	Copy of training policy
	Water tariff		
16	What is your opinion on the sufficiency of the current water tariffs in meeting operation and maintenance costs?	Current per cubic metre cost recovery region threshold	IBNets Tariff database
17	To what extent have the LgWSC tariff proposals been able to reflect inflation and costs of production?		

18	What could be the factors preventing LgWSC from attaining cost reflective tariffs?	Cost reflective tariff barriers	
19	Does LgWSC have substantial autonomy(independence) for proposing tariffs?		
20	To what extent have tariff proposals made by the CU to the regulator been honoured? Has the tariff adjustment process been favourable to cost recovery		
21	How would you describe the willingness to pay by customers?		
	Cost recovery		
22	To what extent do the funds collected from water service charges cover the O&M budget	O&M vs actual collections	Key performance Indicators reports
23	How do you make up for the underutilization of the O&M budget due to cashflow problems?	O&M vs approved budget	Company reports
24	Why do you think your cost recovery ratio is at that level		
25	What are your major cost drivers		
26	Is LgWSC institutionally separated from government? Is the company given substantial autonomy (independence) for operations?		
27	Who is in charge of capital cost expenditure- Govt or LgWSC? Explain		
28	If yes above, what is the role of LgWSC? Which elements of capital maintenance are expected by the utility? To what extent is the utility covering such costs?		
27	What other factors do you think affect cost recovery		

Annex 2 : Questionnaires

Hello,

Thank you for sparing your time to complete the following survey. I am carrying out a research on the influence of operational efficiency and water tariffs on cost recovery in the water sector. I would appreciate your cooperation to fill up this questionnaire. Please note that this questionnaire is confidential and will be used solely for academic purpose.

Name:_____ Date:

Telephone No: _____ Email:

Comments and observations of interviewer:

SECTION 1: Background information

For how long have you been working with the LgWSC?

SECTION 2: Water loss management.

1. To what extent does the utility inventory affect the operation and maintenance programme
   a. No inventory keeping. **b.** Not at all. **c.** Very little **d**. Moderately. **e**. To a great extent

2. Which type of operation and maintenance strategy does your company use more often?
   a. Convenience maintenance
   b. Response to breakdown maintenance
   c. Corrective maintenance
   d. Worst first maintenance
   e. Planned Preventive maintenance

3. How frequent does the number of unplanned services programs occur per year? (Circle response)
   Rarely 1 2 3 4 5 Almost always

4. Are the non-revenue water strategies implemented as per plan?
   1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree

5. Which factor most affects the implementation of NRW strategies in the reduction of NRW in the utility?
   1. Governance 2. Technical 3. Don't know 4. Financial 5. Managerial

6. What is the speed/response time of leaks repair in your company to control NRW?
   a. Above 60 days b. Within 30days c. Within two weeks d. Within a week e. Within 2 days

7. Does the utility conduct pressure management in the system? (Circle response)
   Rarely 1 2 3 4 5 Almost always

8. How often does the utility conduct leakage control?
   Rarely 1 2 3 4 5 Almost always

9. How many times per year do you check meter inaccuracies?
   Rarely 1 2 3 4 5 Almost always

10. To what extent is the occurrence of illegal users?
    Very low 1 2 3 4 5 very high.

SECTION 3: Bill collections.

11. What is your opinion on the reliability and accuracy of the current billing system (Circle response)
    Very bad 1 2 3 4 5 very good

12. Is the occurrence of billing errors within an acceptable level?

Strongly disagree 1 2 3 4 5 Strongly agree

13. What is your opinion on the level of commitment of your customers to paying their water bills?

Very low 1 2 3 4 5 Very high

SECTION 4: Staff Productivity

14. The level of education has implications on service delivery or performance of personnel

Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree

15. If you agree, what is the implication of service delivery in terms of water supply and sanitation?

1. Improved technical expertise
2. Improved cognitive abilities to make proper decisions
3. I don't know
4. No implications
5. Both technical expertise and cognitive abilities are improved

Please tick the appropriate box that expresses the degree of your agreement to the following statements;

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16.	Are there improved financial and other benefits to sustain personnel utilisation?					
17.	Have there been improved financial and other benefits in past three years to sustain personnel utilisation?					
18.	If yes, has the improvement of pay and benefits been used to motivate employees in the company?					

19. Hence, what is your perception of service delivery as a result of improved conditions of service for the workers?

1. Excellent 2. Good 3. Average 4. Bad 5. No change

Staff training & Human resource enhancements and impediments experienced in past 3 years (Please tick the appropriate box that expresses the degree of your agreement to the following statements);

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
20.	Are there financial and other capacities to sustain employee training?					
21.	Has the company incorporated into your activities the aspect of capacity building among your employees to enhance service provision?					
22.	Did your organisation identify training needs and trained personnel to enhance service provision of water supply and sanitation?					
23.	Did your organization match responsibilities with required work to efficiently utilize personnel and enhance service provision?					
24.	Did your organization carry out performance appraisals to ensure that work was output based?					
25.	Does your organization use financial and other benefits to motivate your employees as a means of improving service provision?					

SECTION 4: Water tariffs

I would like to know your opinion on water tariffs. (Please tick the appropriate box that expresses the degree of your agreement to the following statements);

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
26.	In my opinion on the water tariffs are sufficient to cover operation and maintenance costs?					
27.	People are not willing to pay cost reflective tariffs					
28.	LgWSC has substantial autonomy(independence) for proposing tariffs?					
29.	The tariff proposals made by the CU to the regulator have been honoured?					
30.	Tariff adjustments have been favourable to cost recovery					

SECTION 5: Cost recovery

I would like to know your opinion on cost recovery. Please tick the appropriate box that expresses the degree of your agreement to the following statements.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
31.	LgWSC is given substantial autonomy (independence) for operations?					
32.	Government is in charge of all capital cost expenditure					
33.	LgWSC can cover elements of expected capital maintenance using current tariffs					
34.	Lack of maintenance increases costs of operation					
35.	Expenditure pattern explains the failure to recover costs.					
36.	Tariff structure explains the failure to recover costs					

SECTION 5: Service Extensions

I would like to know your opinion on service extensions. Please tick the appropriate box that express the degree of your agreement to the following statements.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
37.	In terms of expansion to underserved areas and improvement of service delivery, do you face financial challenges in doing that?					
38.	In terms of expansion to underserved areas and improvement to service delivery, do you face political interference in doing that?					
39.	In terms of expansion to underserved areas and improvement to service delivery, do you face technical problems in doing that?					
40.	Level of service extension explains the failure to recover costs.					

END OF INTERVIEW

Thank you for your time and for all the information rendered!

Annex 3: Results of statistical tests

Multiple Regression: Cost recovery and (Water tariff, Water loss, Bill collections, Staff productivity)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.880	.863	5.17294

a. Predictors: (Constant), Staffproductivity, billcollections, waterloss, watertariff

b. Dependent Variable: costrecovery

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	46.860	6.926		6.766	.000
	watertariff	1.098	.518	.263	2.118	.043
	waterloss	1.333	.237	.525	5.613	.000
	billcollections	-.686	.530	-.174	-1.293	.207
	Staffproductivity	1.245	.218	.505	5.720	.000

a. Dependent Variable: costrecovery

Correlation tests – Cost recovery with Water tariff, Water losses, Bill collections and Staff productivity

Correlations

		costrecovery	watertariff
costrecovery	Pearson Correlation	1	.393*
	Sig. (2-tailed)		.026
	N	32	32
watertariff	Pearson Correlation	.393*	1
	Sig. (2-tailed)	.026	
	N	32	32

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

		costrecovery	waterloss
costrecovery	Pearson Correlation	1	.784**
	Sig. (2-tailed)		.000
	N	32	32
waterloss	Pearson Correlation	.784**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		costrecovery	billcollections
costrecovery	Pearson Correlation	1	.294
	Sig. (2-tailed)		.102
	N	32	32
billcollections	Pearson Correlation	.294	1
	Sig. (2-tailed)	.102	
	N	32	32

Correlations

		costrecovery	Staffproductivity
costrecovery	Pearson Correlation	1	.825**
	Sig. (2-tailed)		.000
	N	32	32
Staffproductivity	Pearson Correlation	.825**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

2.WATER TARIFF vs Bill collections/Water loss/Staff productivity

Correlations

		watertariff	waterloss
watertariff	Pearson Correlation	1	.287
	Sig. (2-tailed)		.111
	N	32	32
waterloss	Pearson Correlation	.287	1
	Sig. (2-tailed)	.111	
	N	32	32

Correlations

		watertariff	billcollections
watertariff	Pearson Correlation	1	.800**
	Sig. (2-tailed)		.000
	N	32	32
billcollections	Pearson Correlation	.800**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		watertariff	Staffproductivity
watertariff	Pearson Correlation	1	.233
	Sig. (2-tailed)		.199
	N	32	32
Staffproductivity	Pearson Correlation	.233	1
	Sig. (2-tailed)	.199	
	N	32	32

Annex 4: Pictures LgWSC Network

Photograph 1: LgWSC Water transmission line leakage

Photograph 2: LgWSC Meter bypasses

Annex 5: IHS copyright form

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