UNESCO-IHE
Institute for Water Education

The Impact of Infrastructure Development on Water Supply Services and Viability of Small Towns

Case study: National Water and Sewerage Corporation (NWSC) Bushenyi and Kitgum operational Areas

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MSc Thesis: WM-WSM.18-32

March 2018

The Impact of Infrastructure development on water supply services and viability of small towns

Master of Science Thesis
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This research is done for the partial fulfilment of requirements for the Master of Science degree at the UNESCO-IHE Institute for Water Education, Delft, the Netherlands

Delft
March 2018

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Abstract

Service delivery in the 'rural-urban continuum' also known as small towns poses a daunting tasks to providers given the unique context within the towns where scale economies of providing piped water services are low making it unattractive spectrum to venture. This study aims to analyse the magnitude of how the development of infrastructure has affected the financial sustainability and service provision specifically in the small towns of Bushenyi and Kitgum in Uganda whose water supply system is being operated and managed by the National water and sewerage Corporation (NWSC) a government parastatal.

This study majorly applied qualitatively research techniques and data analysis to critically describe and explain how the current processes of infrastructure evolution i.e. the distribution pipe network and treatment plants to expand services in NWSC has impacted on access/coverage and reliability levels of service under the pressure of being financially sustainable in a complicated context of small towns. Secondary data on national water policies and guidelines on infra development in Uganda, NWSC policies, approaches and mandate for services delivery, performance contracts both national and town levels was reviewed. This was to provide insights on how the infrastructure policies and approaches that have significant bearing on investment costs and service levels is developed at the National and NWSC head office and eventually cascaded to the small towns operations.

The Strategic change of focus of NWSC and increased political mandate in the beginning of year 2013 from a profit maximising organization operating in only 23 towns to a wider service delivery model to expand services through infrastructure evolution of the pipe network and geographical expansion of services via rapid takeover of new towns was a turning point that shaped how NWSC provides services in towns. To understand the interplay of the reforms I have conceptualized three chronological phases of how NWSC provides water supply services in small towns in Uganda. These phases are; 1) Take-off phase, the key priority of NWSC is to rapidly develop the pipe network and takeover of more towns to increase access/coverage, increase presence while fulfilling the political mandate of the Government of Uganda but with relative weight of financial sustainability in towns; 2) Stability phase-here the priority is to guarantee supply reliability using lower costs mechanisms to enhance viability of towns thus access is compromised; 3) Landing phase- the ultimate goal in this phase is the financial sustainability of town utilities where focus is to enhance operational efficiencies of towns thru optimizing operational expenditures and improved revenue collection efficiencies to increase net cash flows but at the expense of access and reliability of services.

It is therefore concluded that aggressive infrastructure development does affect the financial sustainability and service levels in small towns but at the different phases of service delivery with varying degree of effect. Given that the mother utility (NWSC) priorities and importance of the strategic goals and mandates to fulfill vary at different phases of service delivery.

Acknowledgement

This study on “The impact of Infrastructure development on water supply services and viability of small towns” is submitted as a partial fulfilment for the award of MSc. Water Management-Water service management at UNESCO-IHE Institute of water Education, Delft, Netherlands 2016/2018. I glorify the almighty God for this achievement.

I would like to profoundly acknowledge the unwavering backing, commitment and professionality from my main mentor Mireia Tutusaus Luque in ensuring that this piece of work is produced with meticulousness. It was through your hard pushes that has made it possible. My utmost gratitude to my supervisor Prof. Margreet Zwarteveen for your intelligent and constructive comments in the course of the research that has enriched this report.

My sincere appreciation and gratefulness goes to ATWATSAN project for sponsoring my studies in the Netherlands, otherwise this would have not materialized. I also extend my credit to project SMALL for facilitating the data collection of this study. Many thanks to UNESCO-IHE staff and students especially from Water Management Programme specifically Water services management specialization for the class debates, group work that tolerated diversity in culture, role plays. This enhanced my intelligence and critical thinking skills that has enabled me accomplish this work. Special thanks to my close friends I met at IHE, Mr.Mbanga Mwasaha, Janvière Tuyisenge, Biar kuai Biar, Isaac Barnes, Dr.Mary Kaggwa, Martin Odeke, Mawoyo Tanyaradzwa, Lungile Sifundza, Richard Mutua, Roberto Narine (my former roommate at Mina), Adriano Mateus Biza, Jussah Nguwo, Maaike Zwarts and to my Dutch family Mr.Hans and Connie, you accepted me and made my stay in Netherland memorable.

In a special way, I particularly recognize the contribution of Dr. Eng. Silver Mugisha the CEO of NWSC, you spared your valued time to discuss in depth about the research, and giving insightful guidance and recommended relevant literature for review that broaden my thinking. Further, my deepest appreciation to all my friends and NWSC top management first for granting me study leave to pursue the MSc and then warmly welcoming me back to undertake research from the organization. Thank you to all my respondents at NWSC head office, Bushenyi area and Kitgum Area. You provided me with all the necessary and valuable data that enabled me put together this report. Special gratitude to the Area Managers of NWSC Bushenyi and Kitgum Francis Kateeba and Faith Nambuya respectively for the unconditional support you gave me during the field work. I also salute the following from NWSC; Sonko Kiwanuka, Gilbert Echelai Akol, Tom Buyi and Rose Mutonyi. I’m grateful for your kindness and being there whenever I needed some support.

Most importantly my family, my wife veronica Ndagire Omuut, I’ll always remain indebted to you for bravely taking up the mantle of taking care of our children Mckenzie Atekit, Malcolm Epetait and Mclean Ojenatum who I left when he was 8 months old but you nurtured in my absence. May God bless you abundantly. I’m also appreciative to my role model Papa Silver Epetait for being an inspiration in my life. To all my siblings thank you for the moral support and prayers. I salute my young brother Jose Ekeun for constantly checking on my family. Lastly I dedicate this work to my late Mum Hellen Atekit Epetait (RIP), you taught me to always be obedient and ambitious son, your legacy will always live.

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Abbreviations

ATWATSAN: Alternative Approaches and Tools for improved Water supply and Sanitation

CAPEX: Capital Expenditure

COM: Cash operating Margin

DWD: Directorate of Water Development

GOU: Government of Uganda

HRW: Human Right to Water

ISDP: Infrastructure Service Delivery Plan

KPI: Key Performance Indicator

MWE: Ministry of Water and Environment

NWSC HO: National Water and Sewerage Corporation Head Office

NWSC: National Water and Sewerage Corporation

O&M: Operations and Maintenance

OECD: Organization for Economic Cooperation and Development

OPEX: Operations and Maintenance Expenditure

SCAP100: Service Coverage Accelerated Programme for 100% coverage

UBOS: Uganda Bureau of Statistics

UNDP: United Nations Development Programme

UNICEF: United Nations International Children's Emergency Fund

VOW: Value of Water Campaign

WATSAN: Water and Sanitation

WBG: World Bank Group

WHO: World Health Organization

WR: Working Ratio

WSP: Water and Sanitation Programme

WSSP: Water Supply Stabilization Plan

WUP: Water Utility Partnerships

WURD: Water Utility Regulatory Department

CHAPTER 1

Introduction

1.1. Background

Sustained population rise in small towns is a concern in the discourse of water and sanitation service delivery. It is estimated that the majority of the global population lives in small urban Centres of less than 500,000 inhabitants (UN-HABITAT, 2006). These towns also referred as secondary towns hosts approximately a billion people in developing countries who by far have low levels of access to basic services like safe water and sanitation (UN-HABITAT, 2006; Mugabi & Njiru, 2006). Estimates also reveal that rapid urban growth will take place in the small cities where coverage of water supply services is still insufficient (Cohen, 2006).

Further, rapid growth has intensified the problem of widening the gap of underserved or unserved population with water supply services (N. Pilgrim et al., 2007). It is reported that at the current rate where population growth in small towns is outstripping the number of people accessing water and sanitation services, more than 672 million people will be living without access to improved sources of water and 2.7 billion people had no access to sanitation by 2015 (WaterAid/BPD, 2010). Although this was estimated for the urbanizing centres the WaterAid/BPD (2010) report however claims that a greater fraction of the underserved population will exist in the small towns. Cohen (2006) also supplements that urban infrastructure development reviews depict that inhabitants of small towns are underserved in regards to basic public services such as piped water supply, health, wastewater disposal, schools among others.

Capital investments in small towns is not matching with the increasing demand for services (WaterAid/BPD, 2010). This is not helped by the fact that majority of the funding for the water sector is channelled to either mega cities or rural areas, in fact (Cardone, 2006; WaterAid/BPD, 2010) estimate that out of the USD $3 billion Official development fund meant for the water and sanitation sector in 2003, only 13% or (USD $360 million) was allocated to the small towns and yet over a billion people with deplorable water supply services is estimated to be living in small towns of developing countries alone (UN-HABITAT, 2006). Expenditure on development of infrastructure to improve access is quite high amidst the escalating demand for maintenance and improving the existing infrastructure. Small towns are in need of capital investments to expand services but do not have the financial capacity to adequately develop the infrastructure thus posing a significant challenge on the level of water supply services (Alm, 2015)

Additionally infrastructure development poses a peculiar problem in small town's financial mechanisms (Cardone & Fonseca, 2006). Mistakes commonly made by planners of town water systems is the use of predetermined national designs standard meant for urban water systems and are transplanted to the town water systems (Lauria, 2003). Given the features of being in

the rural-urban continuum, transitional in growth, towns have distinctive characteristics from urban or rural contexts, therefore requiring a distinctive design strategies of their own (Hopkins et al., 2003). Standard designs have resulted to systems being over designed in order to meet the uncertain projected demand for 20 to 25 years most times not realised leading to excess costs shifted to the clients or risks of ruining the finances of the utility (Hopkins et al., 2003; Lauria, 2003; Pilgrim et al., 2004). This experience in turn has ensued construction of very expensive systems to operate and manage thus serving only a few people who can afford (N. Pilgrim et al., 2007). Thus, the appropriateness of designing town water systems based on growth and demand projection is continuously being questioned (Lauria, 2003) because unreliable and volatile growth is burdensome to the existing population in regards to investment costs and operation and maintenance responsibility (N. Pilgrim et al., 2007).

In times where water utilities are encouraged (if not requested) to strive for financial sustainability, it has posed a challenge to the water sector to realise it (Furlong, 2010). Being financially sustainable is where the utility is able to generate and manage its own revenues to adequately meet its short and long term obligations (Zieburtz, 2008). As part of the problem of financial sustainability it stresses that fixed cost for the development of infrastructure ought to be paid from the beginning of operations but because of a small customer base in towns, the demand and revenues to cover the costs will not be realised in the shortest time (Kessides, 2004).

Besides that, utilities are increasingly required to operate efficient and effective systems that reconcile the expansion of services with minimum incurred costs to enhance autonomy, sustainable services (Kessides, 2004). It is ever more accepted among practitioners that being financially sustainable is the cornerstone for well managed utilities (Rothstein & Galardi, 2007). Therefore, once fixed costs and operational costs are not well managed the end result is unviability of utilities, although governments are encouraged to support utilities with investment costs (Cardone & Fonseca, 2006). In addition, many utilities have a long tradition of pricing their services at rates lower than required to meet the sum of full operations and maintenance costs and capital investments that has resulted into unavailability of sufficient funds for utilities to sustainably provide services. (Zieburtz, 2008)

1.1.1. Problem Statement and Justification

Water and Sanitation service provisioning in towns continue to experience difficulty and some of those specific constraints have also been elaborated by (WaterAid/BPD, 2010; Mugabi & Njiru, 2006; Adank & Tuffuor 2013; P Moriarty et al., 2002). Towns are synonymous with higher costs of investment that is related to construction of centralized systems and yet the revenue generation from these systems are low. Cost recovery mechanisms for at least operation and maintenance of the system are difficult to achieve and also towns find it extremely challenging to generate local revenue from either tariffs or attract external financial support for the development and rehabilitation of infrastructure to facilitate the expansion of services(N. Pilgrim et al., 2007). Furthermore the odd distribution of the population, puts towns at a disadvantaged position to benefit from economies of scale and densities of piped water systems. Towns are very volatile in economic and demographic terms because of being in the continuum between rural and urban areas. Their transitional nature is highly vulnerable to changes in economic activities and the consequences this has on service provision is severe. This position calls for flexibility in approach in designing town water services.

And yet, utilities across the globe and specifically in the small towns are urged to strive for financially sustainable practices to be in position to deliver adequate and sustainable water supply and sanitation services. In order to achieve this, water utilities are encouraged to charge the right price for water, which by so doing, would allow them to cover all operational costs and eventually also any investments. However, setting up these tariffs in small towns is problematic thus inadequate finance to develop additional infrastructure to expand services coupled with lack of technical ability to manage and operate water systems has resulted to utilities in towns not being self-sufficient, (Cardone & Fonseca, 2006).

Given the critical role of infrastructure in increasing access and reliability of services, it is necessary to provide insights on how water utilities of small towns negotiate decisions in regards to infrastructural development to meet increasing demand for water services under the pressure of financial sustainability. Therefore the basis for undertaking this research is to document and bridge the knowledge gap on how the roles of infrastructure development determine financial sustainability strive and service levels in the small town context.

1.2. Research Objective

1.2.1. Main Objective:

The main objective of this research is to analyse how the development of infrastructure has affected the financial sustainability and service levels in the small towns of Bushenyi and Kitgum in Uganda.

1.2.2. Specific objectives

Below are the specific objectives in order to achieve the main objective of the research

- To examine how the current infrastructural development approaches in small town water and sanitation services have been developed.
- To explore the financially sustainable practices that utilities in small towns undertake amidst development of infrastructure
- To establish how service levels suffer or not from the practices/approaches of developing infrastructure

1.3. Research Questions

1.3.1. General Research question.

The key research question for this study is; to what extent has infrastructure development affected financial sustainability and Service delivery in the context of small town's water and sanitation systems?

1.3.2. Specific questions

Question: 1. how are the current infrastructural development approaches in small towns established and who takes decisions

Question: 2. what are the revenue estimates generated from capital expenditure (Capex) and operation and maintenance expenditures (Opex) in small town water utilities. What are practices and measurement of financial sustainability?

Question: 3. how do the service levels suffer or not from the infrastructure development approaches of water utilities in the small towns?

CHAPTER 2

Literature Review

This chapter will give a deeper understanding on the topic of research through a review of literature from journals, articles, working reports, international expert presentations on current debates relating to infrastructure, general financial sustainability in water service provisioning and in a small town context. The sections starts with water service delivery in a small town background, followed by debates for and against financial sustainability and concludes with the dynamics of infrastructural development. It does provide useful definition of key concepts on how they are being used.

2.1. Small town definition

Several understandings of what is considered a "small town" in the water and sanitation context have been put forward by many scholars but still no clear cut definition reached. Many describe small towns based on characteristic such as population, size, management models, the level of development of infrastructure and technology used, operations and maintenance needs of this towns (Ryan & Adank, 2010). However, the seemingly recognized working definition of small towns is gathered from the electronic conference of 2000 that defined small towns as *"settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped schemes, but too small and dispersed to be efficiently managed by a conventional urban water utility. They require formal management arrangements, a legal basis for ownership and management, and the ability to expand to meet the growing demand for water. Small towns usually have populations between 5,000 and 50,000, but can be larger or smaller'' (David & Pilgrim, 2000, p. 5)*

Still, critics of this definition Njiru and Sansom (2002) wonder what constitutes a "conventional urban water utility'? Since there is no agreement on that, and yet there exist many management options with different performance levels. They also reason that there is no proof that supports the notion that conventional urban water utilities cannot efficiently manage small town's water systems. Meanwhile, P Moriarty et al. (2002) contend that, by focusing on piped water systems as the definition suggests makes it shallow because there exist a mix of other technologies in towns. Also towns have a lower population densities making it difficult to benefit from the economies of scale for piped water and affects the choice of technology for service delivery (Mugabi & Njiru, 2006).

2.1.1. Dynamics of small town's water supply and sanitation

Water supply and sanitation services in small towns is a complex situation. First of all there is limited knowledge on how to effectively manage water and sanitation services (WATSAN) in small towns despite of a vast existence of management alternatives for bigger towns, cities and even the rural hinterlands (Njiru & Sansom, 2002). As more people from the rural continue to flock to the small towns or rural growth centres upgrading to small towns, managing Watsan

services may prove to be problematic and explains why there are significantly poor services in these towns.

Literature on small towns whether grey or peer reviewed (Hopkins et al.,2003; Njiru & Sansom, 2002; Mugabi & Njiru, 2006; Pilgrim et al., 2007) highlights some unique challenges associated with small towns in the provision of sustainable water and sanitation services. These towns fall between the gaps of not responding to neither typically urban nor typically rural management models of service delivery (P Moriarty et al., 2002). Understanding of the grey areas known as 'small towns' that is in between the continuum of rural and urban is helpful in developing significant and applicable management models of services (Hopkins et al., 2003). Most of these models have been designed and supported using regular urban systems but transferred and applied in the small town context (De Boeck et al., 2010). However, the context of small towns is essentially distinct from that of primary cities, therefore there precise realisms need to be understood within their contextual opportunities and challenges (N. Pilgrim et al., 2007). Fig 1 is an illustration of the rural urban continuum, the grey area known as small towns.

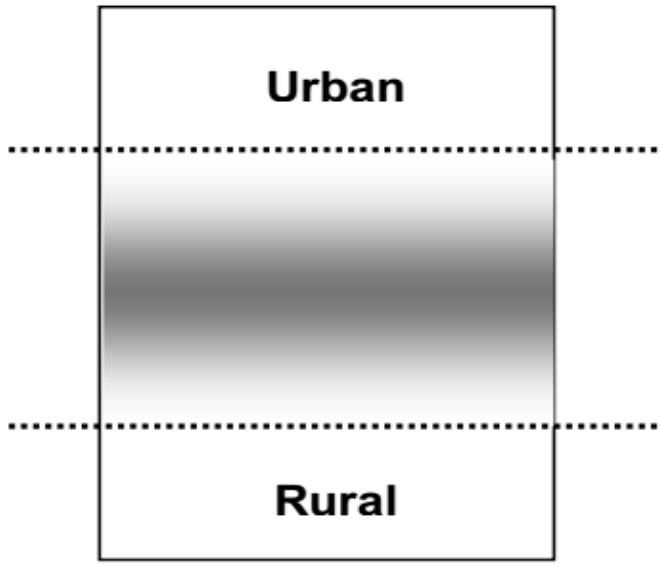

Figure 1: Small town Sub-Sector (Source: Hopkins et al., 2003)

Isolation of small towns in terms of service delivery explains the low levels of services in these secondary towns. It is further reported that due to ambiguity on which approaches of service deliver are suitable for towns, worsens the situations and has resulted into implementation of the inappropriate approaches of either rural or urbanized solutions which do not take into consideration of the local circumstance (WaterAid/BPD, 2010). Further still, small towns had largely been abandoned in respect to investment in the water and sanitation services. They claim that where attempts to develop water systems have been made, services dwindle immediately after commissioning probably due to inconsideration of operation and maintenance provisions or embracing of unsuitable management options (Njiru & Sansom, 2002)

2.1.2. Why is the focus shifting to small towns?

On the low, WaterAid/BPD (2010) suggest that small towns have been ignored because of the rural –urban biases where greater attention from the development community is focusing on the larger cities burdens and the rural poor dilemmas. However, on a national and global scale small

towns are attracting attention simply because many governments and the international community have increasingly realised that towns can provide an opportunity for economic development of a country (Rondinelli, 1983b; Otiso, 2005). The need to Improve services in these towns is for some basic reasons such us; decongestion of the urbanized mega cities, rural economies' stimulation, easing of service provision in major urban centres and ultimately resulting to social and economic development (Otiso, 2004). Additionally WSP (2010a) report emphasize the importance of these towns in providing economic opportunities in terms of employment, reduction of rural-urban migration and the controls the burgeoning of the urban poor in informal settlements of mega cities. Thus shifting focus to towns escalates the need to improve elementary public services in small towns to propel economic growth(Cohen, 2006).

Many international agencies such as the World Bank, African Development Bank, IRC international water and sanitation Centre, Water and Sanitation Programme have organized and sponsored international conferences and workshops specifically to discuss special challenges of small town water and sanitation services (Ryan & Adank, 2010). The "Maputo Practitioners workshop in 2010 in Mozambique" brought together participants across the globe representing policy makers from local government, regulators, private sector, development partners to discuss on sustainable management of small water supply systems in Africa for the emerging small town sub-sector (WSP, 2010a). In the WaterAid (2014) review report on small town's emphasizes the increasing global awareness to prioritize delivery of improved water and sanitation services to small towns and it was one of the major focus areas of Water Aide's universal strategy of 2009 to 2015

2.2. Financial sustainability and full cost recovery in water service delivery

Financial sustainability in public services provision may have many meanings and understanding depending on the context being referred too. Here, financial sustainability is referred to as the ability of the utility to acquire and manage financial resources sufficient to allow it to meet its mission over a longer horizon (Zieburtz, 2008). To provide sustainable quality and reliable water services, utilities in small towns are urged to operate in a healthy financial management system where the revenues of the utility at all time are in excess of the sum of the operational costs, capital costs and environmental costs. The reasoning behind is because government and donor subsidies are increasingly becoming unreliable, untenable and costly in terms of debt service. Worst of it, studies have shown at a global scale, a declining trend of aid financial flows to the water sector since 1999 from the international donors thus the need to be self-sufficient (OECD, 2004; Cardone & Fonseca, 2006).

In the World Water Council's report by Cosgrove and Rijsberman (2000:2), the World Water Vision incorporates the "move to full-cost pricing of water services for all human uses" International water bodies like the World Water Council equally supports the notion of full cost pricing of water as a deliberate step towards the recognition of the full economic value of water and its externalities. It is maintained that financial resources need to be available at all time to immediately address whatever challenge the utility may encounter in their daily operations, therefore, the appropriate pricing mechanism of water services is a critical component in any sustainability plan. However, the question of the day is to what extent should water prices charged by utilities recover costs? Many argue that the price of water and wastewater services should communicate with the true cost of providing water and waste water services to consumers (Zieburtz, 2008). other studies have also shown a general consensus that services

must be paid for even the poor are prepared to pay for improved services to recover costs of the service provider (Jaglin, 2002). Therefore full cost recovery from users is emphasized in recent years.

Adequate finances enables the utility meet its short and long term goals of continuity of water supply, equitable distribution of water, expanding coverage among others (Zieburtz, 2008). However studies have shown that the prices of water charged by utilities have failed to recover the investment and even O&M costs and is hindrance to adequate service delivery (UN-HABITAT, 2006; Cardone & Fonseca, 2006; OECD ,2010). Long term survival of the utility is hinged on its financial strength now and this can be achieved through adequate external funding, careful spending, prudent planning and appropriate controls of its internally generated revenues.

Utilities both in larger or small cities are encouraged to be financially stable due to the complexity involved in managing water and waste water services coupled with the growing need for development of infrastructure which require significant amount of capital expenditure (UN-HABITAT, 2006). The capital intensive nature of the infrastructure places the capital financing at the heart of the development of sustainable utility financial plans (Rothstein & Galardi, 2007). This infrastructure used to treat and transport water needs to be sufficiently maintained, it is an important measure in ensuring safety of drinking water. Poorly maintained water supply systems especially in developing countries is attributed to insufficient financial resources and poor asset management (Khatri & Vairavamoorthy, 2007), therefore the deterioration of the infrastructure threatens the ability of the utilities to deliver, reliable, quality and safe drinking water. In addition, the high levels of Non-Revenue water between 40-60% according to Khatri and Vairavamoorthy (2007) in developing countries is attributed to poorly maintained and manged water infrastructure. This therefore is a reflection of how being financially sustainable is fundamental for utilities in water service provisioning.

2.2.1. Conflicts of full cost recovery to achieve financial sustainability

Controversy faced by Water service providers (WSP) in the pursuit of financial sustainability is the strong criticisms from the human rights to water (HRW) activists who view this objective as a neoliberal ideology that promotes privatization of services that aim for profitability and full cost recovery rather than service delivery. It sparks off another debate on whether water should be managed as an economic resource or public/social resource. HRW activists Mirosa and Harris (2012) argue that access to water resource is a fundamental human right, therefore it should be managed as public/social good by the state or public utilities that promote the end goal of equity, universal access and efficient service delivery and managing water as an economic good will deprive the majority poor the HRW.

Sharp conflict in water service provisioning is observed especially where there is considerable overlapping authority of government agencies and regulations in the water sector. Most public water utilities are mandated by law to operate in a commercial and viable manner, financially sustainable and autonomous, take an example of NWSC in Uganda and Zambian utilities where the principles of private enterprises are promoted (Schwartz, 2008).. However, quite often, there exists contradictions with the national laws that are in support of equity and universal access of water services, thereby reducing the role of utilities as basic service providers.

Critics of cost recovery principles Marson and Savin (2015) present quantitative empirical evidence that shows the relationship of cost recovery and access not being linear in three

dimensions. 1) Utilities with poor financial performances cannot increase coverage due to lack of own funds to invest while donors and governments are hesitant to invest in loss making WSP; 2) Utilities with moderate cost recovery can increase access because of availability of own funds, government and donor support because of the financial sustainability of the investments; 3) strong focus on full cost recovery doesn't increase coverage simultaneously because the overstated focus on financial performance provides a disincentive to extend coverage to unprofitable peri-urban areas. It is concluded that good financial results do not necessarily translate into corresponding increase in coverage as supported by qualitative studies (Marson & Savin, 2015; Bakker et al., 2008; Bayliss, 2011; Dagdeviren, 2008; Herrera, 2014; Jaglin, 2002) because utilities are incentivised to focus more in high income areas where they can make profits forgetting low income areas.

Increasing water prices in the name of full cost recovery for utilities to be financially sustainable as being promoted is in fact triggering more problems on the already existing ones in water supply sector therefore increasing prices of water will worsen the poverty levels (Jaglin, 2002). Because of increase in prices, the utility also stands a risk of losing out on revenue because of non-payment by consumer that will obviously impact on its cash flow. It is acknowledged that improving financial sustainability of public utilities is necessary but not at the cost of social objectives. Bayliss and McKinley (2007) complement this view, in that as a result of high costs and low incomes in sub Saharan Africa, heavy reliance on cost recovery is neither viable nor socially desirable.

Additionally UNDP policy brief report also claims that on top of the worsening poverty level, full cost recovery may lead to greater inequality across region as sighted in the case of Namibia where wealthier regions with low cost of supplying water actually pay lower prices as compared to poorer regions that pay more due to high costs of supplying water (Bayliss & McKinley, 2007),. Majority of the population in cities or towns of developing countries where striving for social objectives has been postponed live in worsening poverty and flaring inequality (Jaglin, 2002). It is said that for utilities to recover O&M costs is reasonable but full cost recovery is far from being attainable in developing countries (Schwartz, 2008). Already the poor are paying more for water services because of relying on water vendors who charge exorbitant prices not because they can afford but because they have limited options.

In summary the assumption that full cost recovery will translate into utilities remaining financially sustainable in the future is continuously being questioned and debatable. Empirical evidence as presented by Marson and Savin (2015) has it that strong emphasis on full cost recovery will not led to automatic increase in access of service. However, what is generally acceptable is that service providers need to be self-sufficient in order to sustainably provide services.

2.3. Dynamics in developing water infrastructure

It is important to understand what is meant by infrastructure from the global perspective right from the start of this section to set the stage for the debates and discussion on infrastructure development in water supply that will follow. Alm (2015) broadly defines infrastructure as capital facilities with long lifespan that enable the delivery of certain services in urban cities, small towns, rural and household levels and also offer services that boost production in the private sector. These may include services from power generating plants, transportation systems, telecommunication, and water supply and sanitation systems among others.

However, for the purpose of this research the centre of discussion will be on water and sanitation infrastructure specifically in small towns. Here water infrastructure will be referred to as structures and services that are being operated by water and sanitation utilities in small towns regardless of whether public or privately owned (VOW-Campaign, 2017). In the provision of portable water supply and sanitation services whether in conventional urban systems, intermediary towns or rural systems there is specific type of water infrastructure or technology that is required to accomplish service delivery cycle. Such critical infrastructure compromises of network pipes, water and wastewater treatment plants and pump stations, storage tanks, sources (wells, intakes of surface water), pumps, water meters and land. These are some of the fundamental assets that facilitate the delivery of water and sanitation services in towns (Hopkins et al., 2003).

2.3.1. Challenges of infrastructure development

Availing infrastructure requires utilities to have the technical capacity to manage, operate and maintain the assets, planning and financial mechanisms in place, the ability to acquire more of infrastructure for the expansion of services (Alm, 2015). However, many utilities in developing countries struggle a lot in the acquisition of this infrastructure let alone, have failed to sufficiently maintain and manage the assets. Briceno-Garmendia et al. (2004) suggest that increasing access and quality of infrastructure services needs sizable investment and expenditures on operations and maintenance. However, this is contentious in the small town subsector, as the population exist of the majority poor who are mobile with varying willingness and ability to pay, yet the infrastructure is immobile and requires to deliver as promised by design and affordability (Cardone & Fonseca, 2006). However, due to the capital intensive nature of water infrastructure that requires large funding poses a big challenge to utilities in small towns, as they do not have adequate funding to meet the growing demand for more infrastructural services (WaterAid/BPD, 2010).

2.3.2. Critical role of infrastructure

The development of infrastructure is generally recognized as a springboard for economic growth for countries especially developing countries and facilitates sustainable provision of services (Briceno-Gamendia et al, 2004; Alm, 2015; VOW-Campaign, 2017; Kessides,2004; World Bank, 1994). Because it “increases productivity and reduces the production costs, it has to develop faster to match growth” of countries (World Bank, 1994, p. 2). Infrastructure that is reliable contributes directly through supporting the delivery of crucial services such as increasing access to safe drinking water, adequate sanitation, health and education that lead to social development thus indirectly reducing poverty in developing countries although in many developing countries there is still a deficit in infrastructure resulting into poor quality services in small towns (Briceno-Garmendia et al., 2004).

However, there has been some debate and scepticism on the actual direct linkage that infrastructure contributes to the economic growth of a country later alone a municipality or a town (World Bank, 1994). Various studies on many countries report mixed results on the impact of infrastructure on growth. According to Briceno-Garmendia et al. (2004), more than half of studies have shown that investment in infrastructure has insignificant effect on growth or productivity and even some find negative effect. Although Estache (2010) debates that infrastructure may be necessary for the functionality of current economies but it is not necessarily that more infrastructure will automatically cause additional growth altogether in the various phases of development. In other words infrastructure matters but does not have to

explicitly conclude whether more or less infrastructure investments contribute significantly to growth. Emphasis from recent studies have shown that infrastructure development on economic growth has a high rate of return to investment of close to 6o% (World Bank, 1994:15).and also due to the multiplier effect from the infrastructural services, production costs are lowered and expansion of market opportunities (Prud'homme, 2004; Estache, 2010). This is illustrated in the figure 2 below

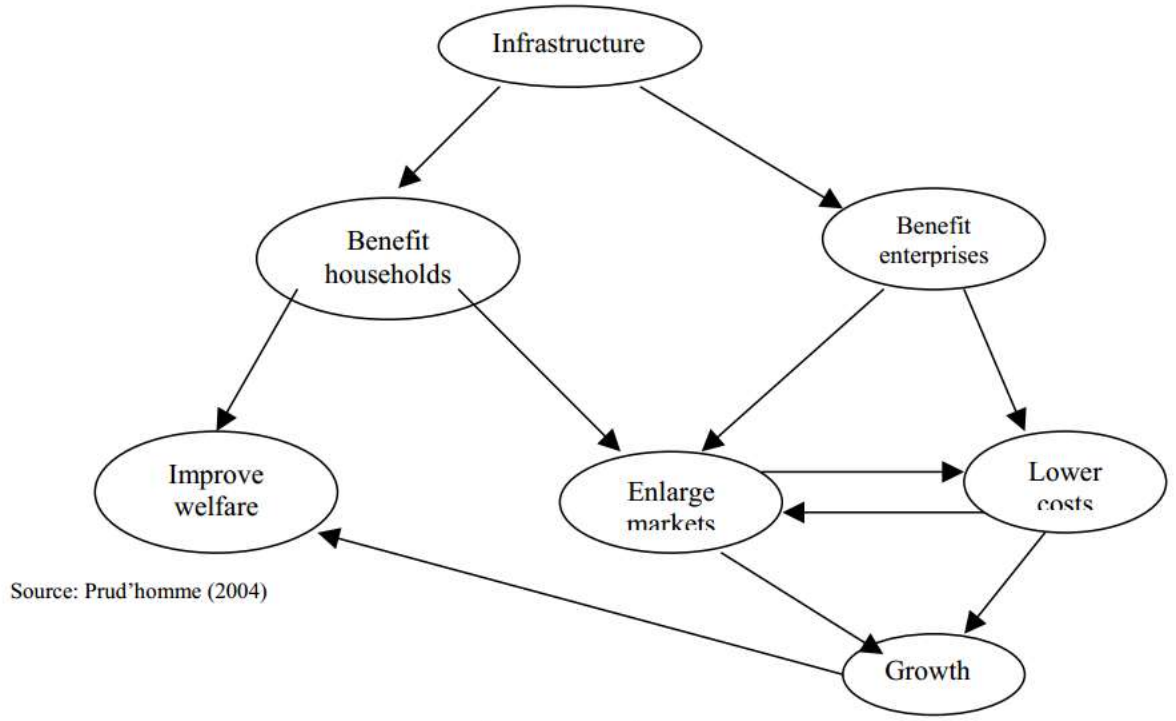

Figure 2 How Infrastructure contribute to development source: (Briceno-Garmendia et al., 2004, p. 4)

2.3.3. Choice of Technology in water service delivery

There are varying technologies used for providing services in different contexts of urban, towns and rural that have direct implication on the sustainable delivery of services such as; water and sanitation, environmental services, health, Education and social justice (Furlong, 2011). Therefore consideration of local condition is important for the suitable choice of technology Hence making a choice of appropriate technology for sustainable delivery of such services is paramount and is reliant on those who can afford it (Pilgrim et al., 2004). Technological option involves selecting a suitable technology taking into consideration of the political, environmental and socio-economic factors that fulfil preferred needs and objectives (Mara & Alabaster, 2008; Prabhu & Vizayakumar, 1996). Interestingly. developing countries have a tendency to import and implement technology and infrastructure designs of water systems without due consideration of the local conditions and necessities and quite often a number of such projects have failed and technologies abandoned (Lauria, 2003; Paterson et al., 2007).

Traditionally the water and sanitation sector has relied on two types of technology (centralized and decentralized) in the delivery of services. Centralized systems is where there is only one or a few small treatment/production plant of portable water and water is distributed to the town using pressurized mechanisms, in contrast to the decentralized systems water/wastewater is produced and supplied at individual or community level for instances, supply is from individual

or community wells (Daigger & Crawford, 2007). Centralized systems have become more dominant and preferred choice of technology for urban water systems since they offer the best possibilities to provide 'cheaper' water than other models as the marginal costs of offering the last drop of water will be minimised in a centralized system (rather than in separate decentralized systems) and they are operated mainly by monopolistic public utilities in developing countries (World Bank, 1994, p. 6).

On the other hand, decentralized systems considered as an alternative technology has been looked at as suitable for the rural areas or the peri-urban centres of the large cities where the utility services are inadequate or non-existent. The alternative technology quite fittingly seem to answer the needs of the inhabitants of these areas because it involved simple and easy to maintain and manage water systems at the communal management. Njiru and Sansom (2002) agree that the technology opted by small towns for extending services is crucial for the management of water supply systems.

2.3.4. Complexity in Town Water Infrastructure designs

While designing what supply and sanitation systems, integration of the technical and financial viabilities of these infrastructure is emphasized. In fact Pilgrim et al. (2004) stress that there should be no room for blunder in the design phase of town water systems because any mistake will result to substantial financial impact on tariffs and definitely affect the financial sustainability. High initial investment costs are either transferred to the consumers or utility bears the burden of recovering the costs from other sources of finance which is not sustainable in the small town sub-sector. Likewise, in communities where population densities are unpredictable and unevenly distributed, understanding the cost savings that may result from the planning and development of network infrastructure is critical for planners (Mizutani & Urakami, 2001). Additional the design approaches adapted in towns are encouraged not to be reliant on finances from the government and other funders for investment (Pilgrim et al., 2004). To lessen this, a vigorous process in planning and designing of town water supply system ought to be undertaken to reduce on costly errors that may jeopardize the system Lauria (2003)

From the many design strategies suggested for town water and sanitation service delivery, the phased or modular expansion strategy seems to be the encouraged and preferred option according to literature on design models of infrastructure for small towns(Hopkins et al., 2003; Lauria,2003). Here, towns need to plan to meet the current demand that reduces the start-up costs and progressively plan to enlarge the system based on actual demand and willingness of future customers to pay for services (Pilgrim et al., 2004). This approach would reduce the gap between costs of the system and revenues to enhance financial sustainability

2.3.5. Infrastructure Economies of scale

A close scrutiny on the economies of scale can fetch significant savings in the water sector once carefully analysed in the development of infrastructure (N. Pilgrim et al., 2007). Nonetheless, for us to fully grasp where the benefits accrue from, we need to first understand the meaning of the concept of economies of scale in general terms. In the world development report World Bank (1994, p. ix), economies of scale is referred to as "a characteristic of a production technology whereby unit costs decline with increasing output over a large range. Economies of scale are a major source of natural monopoly''.

Traditionally, Water infrastructure is capital intensive and requires significant amount of capital expenditure to develop it thus making it monopolistic in nature, has no competitor and it is seen

as being wasteful for a community to have many utilities supplying water. Therefore it is developed based on the assumption that the bigger the infrastructure the better as there is potential to exploit the economies of scale (Ansar & Pohlers, 2014). This reasoning is valid from the economic perspective considering that the long run cost of production will decline as the utility produces additional cubic units of water from one particular infrastructure say for instance from a treatment plant. Hence the water industry has customarily followed this paradigm of the ‘’the bigger the better’’ or the bigger the cheaper to produce long term outputs while developing urban water systems (Ansar & Pohlers, 2014). This is illustrated in figure below

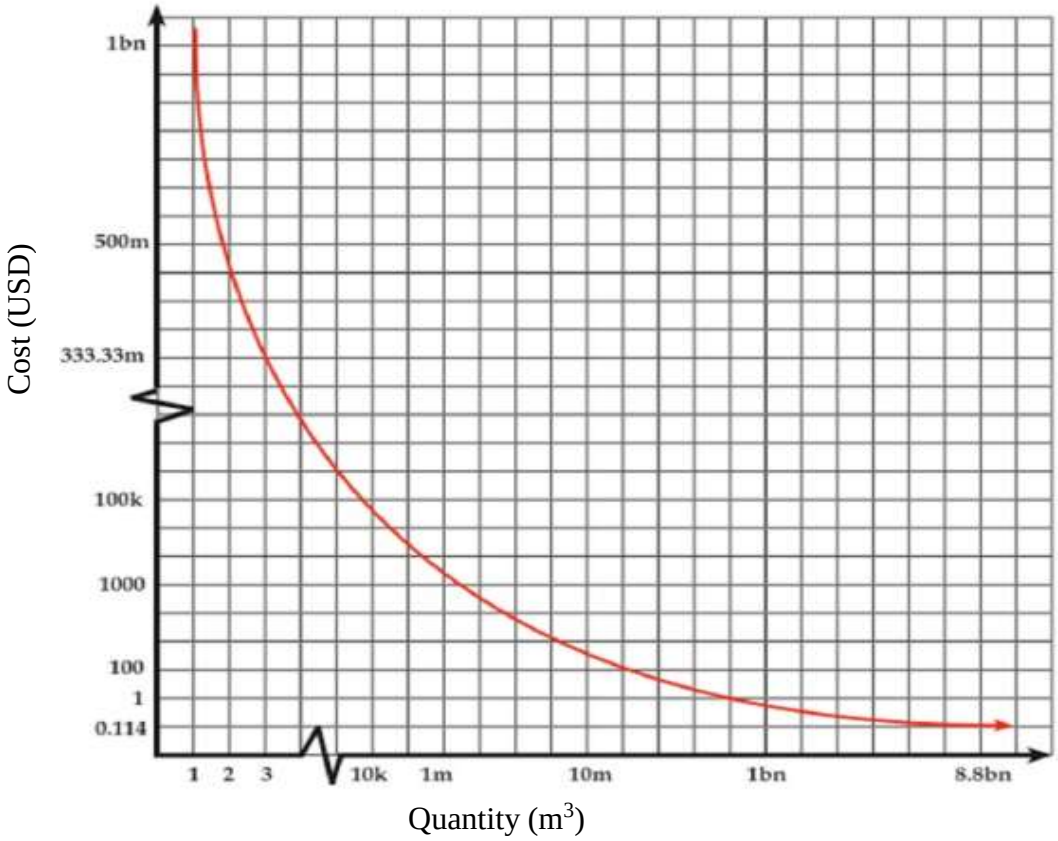

Figure 3: Declining long run average cost curve of water production: Source (Ansar & Pohlers, 2014, p. 255)

However, some authors criticise this conventional theory of development of infrastructure particular for small towns. Lauria (2003) argues that the bigger the system may not necessarily mean the better. These bigger systems provide for excess capacity which is reliant on demand that is (number of user connections that will be made in the future, connection rates, and per user consumptions), seldom is demand realised in towns (Hopkins et al., 2003). Therefore excess capacity should not be the overruling assumption but projected with certainty thus consideration of alternative designs with or without excess capacity should be encouraged (Lauria, 2003). In addition, the above understanding of infrastructure development is based on two assumptions; 1). Demand is predictable and will be realized; 2). Only production costs are considered. However, in small town’s demand is fragile and not easily realized, utilities face difficulties in accurately forecasting demand (Flyvbjerg et al., 2005), O&M costs of the system are not considered and yet these are fundamental costs for the effective operation of the system.

Also if water systems of towns are not appropriately designed there is a risk of missing out on the economies of scale thus leading to high costs of investment, operations and maintenance costs which will ultimately affect the financial viability of the utilities (Hopkins et al., 2003). Take an example as demonstrated by N. Pilgrim et al. (2007) where planners need to be mindful that the cost of network pipes (both water and sewer) is mainly determined by the length of the pipe but not on the diameter of the pipe, therefore its less expensive to construct a large pipe network that will accommodate for the growth of population density instead of constructing a relatively smaller one that allows for modification to cater for changes in population distribution. As a result, pipe network diameters have high economies of scale with regard to their flow capacity whereas building longer networks for predicted demand have no economies of scale related to it (Lauria, 2003). Understanding such dynamics of infrastructure development is critical for decision makers in expansion of services. However , this technical knowledge on design of water systems is lacking in small towns because they do not have the capacity to hire specialists to plan and manage water systems to expand services (N. Pilgrim et al., 2007)

2.3.6. Economies of Densities

This is particularly important for developing countries where a big number of people still are without adequate access to safe drinking water and sanitation services, so if there is evidence of economies of density more network expansion and new connections can be made at a decreasing average cost as empirically measured by Nauges and Van den Berg (2008). To supplement these findings Cohen (2006) contends that there are lesser per capita cost in providing basic services and infrastructure in areas that are densely populated than low population densities. Conspicuously small towns have low population densities and hence limited economies of densities, this implies that more infrastructure is needed to serve the same amount of people as evidenced by the study conducted by Nauges and Van den Berg (2008). therefore, the realization of economies of density assumed in a 'regular' larger urban centre are not applicable to small towns (Pilgrim et al., 2004). Economies of densities are more visible in cities due to the high population density which are not realizable in the small towns.

2.4. Infrastructure development and water services

Water infrastructure generally is a foundation in the delivery of water supply and sanitation services for any water service provider whether in urban, peri-urban, rural, or secondary towns. Indeed water services may be defined as the delivery of access to water in such means that meets a given set of indicators or standards, when these indicators are put together they define the service (Moriarity et al., 2011). Although most infrastructure performance evaluation criteria have tended to focus on financial and operational efficiency of the infrastructure, prioritizing it may come at the expense of consumers, employees of the utility emanating from high prices and reduced levels of services (Kessides, 2004). Importantly in the discussion of water services delivery is the level at which services are to be offered by service providers. Service levels in simple terms refers to a descriptive and differentiation between qualities of services (Moriarity et al., 2011). Moriarity et al. (2011) further explains that service levels vary from one country to another, may be set according to social and political factors, costs etc. however, according to him the commonly used indicators that guide in evaluating the quality of water services contain; Access, reliability of services, quality and quantity stated in litres per day per capita. More elaboration on service level indicators follows in the next subsection.

2.4.1. Infrastructure impact on Access of services

Getting a universal understanding of access of services is problematic its self in countries but also among sectors. However, the commonly used definition is that of UNDP which translates access to a percentage of the population that is using improved sources of water such as piped water, public stand taps, motorized boreholes, improved springs and wells (Kayaga et al., 2009). Other international bodies like the World Bank categories access into rural and urban, where by in urban, households are considered to have access if within 200 meters of safe water sources while for rural access implies spending less hours of the day collecting water. A clear manifestation of the need for more infrastructure development to bridge the gap of access to services,

It is no secret that access or coverage of water supply and sanitation services is directly proportional to the level of development of the infrastructure in countries. No wonder, urbanization through infrastructural development is one of key drivers for the tremendous progress in the increase of global access to water and sanitation (Patrick Moriarty et al., 2013). This is not only restricted to cities but also the small towns of population of less than 500,000 people and the rural growth centre (UN DESA, 2011; Patrick Moriarty et al., 2013). The impact of infrastructure on access of services is reflected on the number of connections made. It is claimed that the rapid increase in the total number of customer connections in 2004 by NWSC was attributed to the increased capital expenditure on infrastructure that drastically improved access/coverage from 48 percent in 1998 to 65 percent in 2004 (Mugisha et al., 2007). It is further reported that countries with high access of greater than 70% rely on piped water services to house connections, although in developing countries in sub Saharan Africa and Asia are nearing the coverage rate of 70% despite depending on point sources, they are most likely to change to piped water services to house connections. This pits infrastructure at the forefront of increased coverage.

On the contrary policies on infrastructure have significantly injured the poor, mostly through inability of policies to provide universal access and not taking into consideration the incapacity of the poor to pay and afford infrastructure services (Estache, 2010). Moreover affordability of these services is part of a bigger problem. Estache (2010) illustrates that by practitioners relying on World Health Organization definition of affordability where by households are not supposed to spend more than 5% of their income on water which is contrary to the generally proposed informal rule of not more than 15% income heightens the problem. Therefore the poor are most doubtful to afford the infrastructural services. The access gap of services between the rich and poor is widening, On a global perspective the gap between the deprived and the richest 20% of the population is steadily greater in the low developed countries Estache (2010) as demonstrated by the table below

Table 1: Access to infrastructure by the richest and poorest 20% of the population

(% of Population receiving services)

	Electricity		Water		Sanitation		Telephone	
Country grouping according to Income level	*Poorest 20%*	*Richest 20%*	*Poorest 20%*	*Richest 20%*	*Poorest 20%*	*Richest 20%*	*Poorest 20%*	*Richest 20%*
Low	9.7	68.7	41.1	78.5	27.2	68.8	3.2	24.5
Lower-middle	79.5	99.3	64.5	86.6	48.2	78.7	21.2	66.1
Upper-middle	81.4	99.5	76.7	95	73.4	96.4	32	73.1

Source: (Briceno and Klytchnikova, 2006; Estache, 2010)

2.4.2. Infrastructure impact on reliability of services

Service reliability indicator in water services is widely reported as the best indicator to measure the quality of services provided and is measured in terms of hours per day that users are supplied with water and the proposed target is 24/7hr supply, which has relatively been met by over 50% of utilities in developing countries(Schwartz & Schouten, 2015) . Other author's measure reliability of services in two folds; I) at the water taps of consumers which effect is as a result of direct control and management of the distribution network and II) at the production plants (Tumusiime & Njiru, 2004). In a different view, Moriarity et al. (2011) look at service reliability as people being aware that they can have access to water of good quality and quantity from a particular source at a certain time and it is also measured in terms of promptness and consistency. Therefore if water services are provided punctually after a certain schedule, even if it is after three days that service is measured to be reliable. Nonetheless, the typically challenging unreliable services include those that where there is frequent breakdown of the infrastructure, it is not repaired on time and inconsistent in supply (Moriarity et al., 2011), therefore state of infrastructure is crucial in reliable delivery of services.

CHAPTER 3

Research Methodology

This research is inspired by the author's personal experiences of working with utilities in small towns in Uganda and motivated to document in detail the underlying struggles that utilities undergo in providing water supply and sanitation services. This chapter of research methodology, is organized in six main sections which comprise of; research design, multiple case selection. Analytical framework, data collection techniques and limitation of the research

3.1. Research Design

The research applies qualitative research methods that involved semi structured interviews and observation of the current situation of water supply provision in small towns in Uganda. I find this approach suitable since the research seeks to describe and explain how the current processes of infrastructure development to expand services affects financial sustainability in a complicated context of small towns. Therefore the research question is answered thru the qualitative techniques while correlating it with some quantitative data, since the study seeks for an explanation and description of the current situation in a particular context (Lowhorn, 2007). This research comprised of three different phases, which included proposal writing and literature review, data collection from the case studies and data analysis of the content collected from the field and report writing.

Review of literature- this involved critical review of existing scientific knowledge surrounding the applied concepts and debates on financial sustainability, infrastructural development, water services and small towns. In search of relevant literature on the subject, various scholarly search engines such as science direct, google scholar, Scopus, were explored for the soft copy of the grey and peer reviewed documents, articles, books and book chapters, journals and reports. For the hard copies, the IHE library service desk was contacted. To backup, the scientific literature other relevant documents consulted include the UN reports, water and sanitation programme reports, World Bank reports, Utility partnership report among others. This widen the knowledge base.

Multiple case study (data collection) - this was carried out from two towns of Bushenyi/Ishaka and Kitgum water supply system and NWSC head office being the national utility in Uganda that manages urban piped water systems. Multiple case study was preferred because it enables identification of unique characteristics of case studies through exploring resemblances and differences and to a certain extent allows for generalization of findings (Daymon & Holloway, 2010). Therefore the rationale for choosing this research design method is to provide an in depth description of how each utility's version of growth of infrastructure has affected their financial sustainability and service levels. Similar traits and differences in service delivery in the towns is identified

Data analysis- this is the critical final stage of the research processes because its where we find the ''major findings or the big picture'' of the research after carefully carrying out a comprehensive data interpretation to describe a phenomenon (Hancock et al., 1998). For this

research the unit of analysis centred at the NWSC head office and the operational towns of Bushenyi and Kitgum. Where the concepts of infrastructural development, water services and financial sustainability are operationalized. It is viewed through the lenses of infrastructure, financial flows and service levels to determine the relationships in the context of the small town's water utilities.

3.2. Multiple Case Study Selection

The decision of selecting the case studies for this research was majorly based on two water supply and sanitation projects. That is project SMALL and ATWATSAN project being implemented in Uganda. The project sites are within the case study small towns of Bushenyi and Kitgum. Project "SMALL'' is currently analysing the existing water and sanitation service models in the small town of Bushenyi with the objective of developing ''fit for use'' models to improve performance of water and sanitation services in the small town where the users will have access to safe, reliable and affordable drinking water (Tutusaus & Ferrero, 2017). The project therefore facilitated my research expenses since the findings would contribute to the project objective.

On the other hand the ATWATSAN project being the main sponsor for my MSc studies at IHE-Delft is implementing water supply and sanitation project in the small towns of Northern Uganda where Kitgum town is located hence the selection of Kitgum town as a case study. One of the objective of the project is to increase coverage and reliability of water supply services in northern Uganda small towns (ATWATSAN, 2016). The theme of the research aligns with this project objective and it will contribute in understanding how the current infrastructure development has affected the viability and service levels in the town of Kitgum.

This research, therefore reviews the development of water infrastructure such as; production/treatment plants and distribution network that was developed or still being constructed in the two towns of Bushenyi/Ishaka and Kitgum for the period 2013 to 2017. The focus on this review period is mainly because it has been reported that in the financial year 2013/2014 NWSC launched a five year strategic direction that aimed for rapid expansion of services through rapid development of infrastructure and geographical expansion by taking over more towns (Mugisha & Berg, 2017)

3.2.1. Geographical locations of study towns

Bushenyi municipality - is located on the south-western region of the country with an estimated population of 42,000 inhabitants. The water supply system is being managed by NWSC Bushenyi Area, however it also has administrative and financial control over nine (9) other independent smaller water systems in the branches of Kabwohe, Kitagata, Bugongi, Rubirizi, Kyabugimbi, Kashenshero, Mitooma, Kabira and Buwheju to form the greater ''Bushenyi Cluster Area'' that covers 590km. With a total customer base of 8,646 they serve 65% of the total population but have no conventional sewerage system NWSCBushenyi (2017)

Kitgum municipality: -is one of the recently taken over operational towns of NWSC, situated in the Northern region of Uganda has a population estimate 44,000,000 people. The main economic activity is subsistence agriculture, the water supply system is under the management of NWSC Kitgum operational Area, and there is no conventional sewerage system. The two towns are located on the Ugandan Map as shown below.

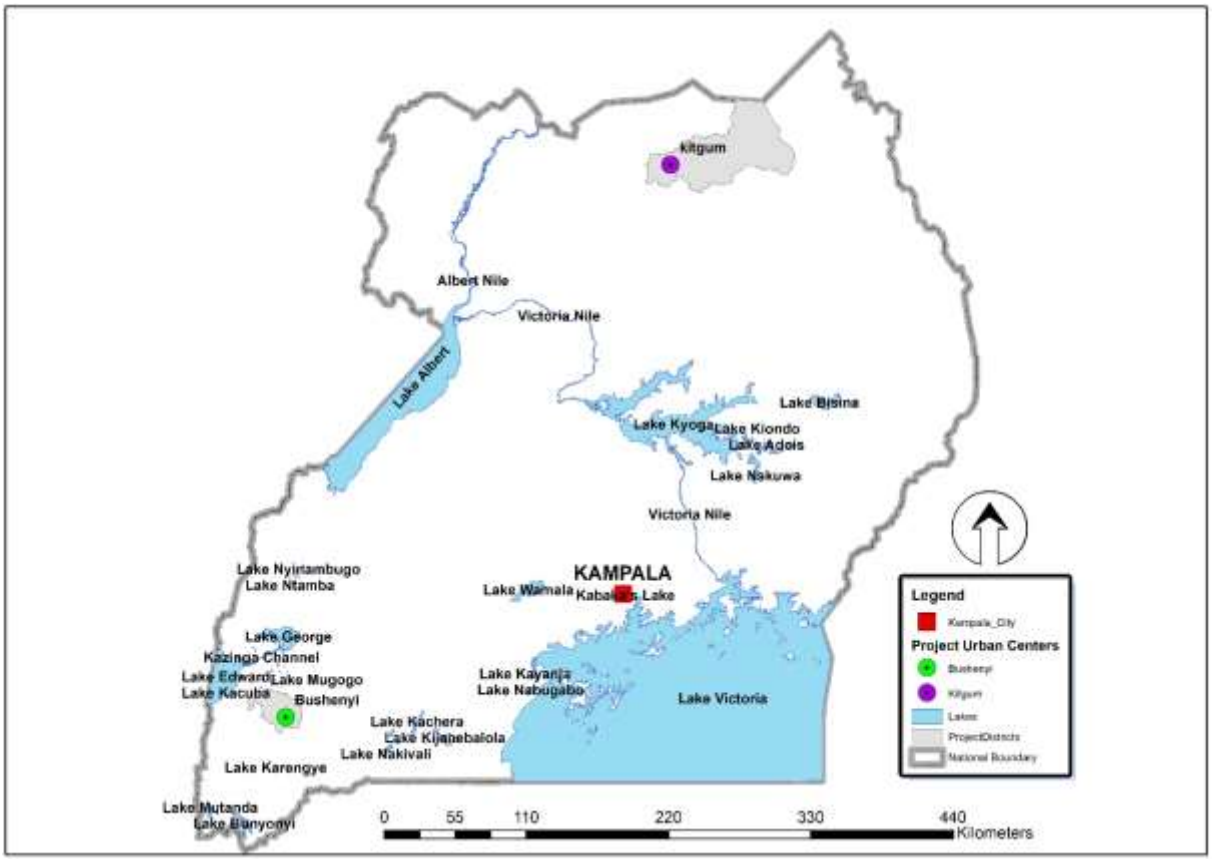

Figure 4: Map of Uganda with the locations of Bushenyi/Ishaka and Kitgum Towns

3.3. Analytical framework

To be in position to comprehensively understand the sacrifices that utilities' of Bushenyi and Kitgum undertake while striving for financial sustainability amidst infrastructure development to expand services. The research uses the Concepts of infrastructural development, water services and financial sustainability to explain the dynamics of water supply and sanitation services in the small towns. These concepts are used to build the analytical framework that gives a broader perspective of the research objective and hence vital for answering the research question.

3.3.1. Lens of analysis: utility management Drivers

Key driving forces in the sustainable delivery of water supply and sanitation services that enhance service levels involves utilities having sufficient financial flows for capital investments as it is increasingly being advocated (OECD, 2009). Therefore the study seeks to explore these concepts through the lenses of infrastructure, service levels and financial flows from NWSC head office and how it is cascaded to the operational towns. These concepts are fundamental for improving efficiency, accessibility and sustainable management of water supply and sanitation services in utilities as echoed in the Kampala statement (WUP, 2001). Below is further explanation of the lenses

3.3.2. Financial flows

Traditional sources of finances in the water and sanitation industry are commonly known as the 3Ts, that is Tariffs (customer charges), Taxes (public coffers) and Transfers (official

development Aid, grants) (OECD, 2010). The research will study the financial flows from NWSC head office to the operational areas of Bushenyi and Kitgum and explicitly providing how the concept of Financial sustainability is understood and the applied financial indicators for measuring it such us working ratios, cash operating margins (difference between revenues and expenditures) and collection Efficiencies (percentage of the billing that is collected) is being defined at NWSC headquarter and translated to the operational areas.

Additionally, the research will also study the NWSC costs and revenues associated with service delivery to the towns, that is, Capital expenditures (Capex) and operation and maintenance expenditure (Opex) (Moriarity et al., 2011). Further seek to study the financial mechanisms for sustaining service delivery within the town utilities and also explore whether there are other possible sources of financing besides the traditional ones, for example, bonds in the market, direct private investments, equity, micro finance, guarantees among others as explained by Cardone and Fonseca (2006). Although government is inclined to fund most of the capital investments in small towns but tariffing is acknowledged as the suitable source of financing for operations and maintenance for utilities to enhance their financial sustainability (Alm, 2015; Cardone & Fonseca, 2006).

3.3.3. Infrastructure/technological choice as key focus of Research

Infrastructure and financial flows in the water sector industry are vastly interconnected to each other in that the choice of infrastructure/technology to be developed by utilities will control the rates at which water will be priced. In this research, I focused on treatment/production plants and distribution network because of indication of access. Also infrastructure is fundamental in achieving the sustainable development goal of universal access for water and sanitation (UNDP, 2015). Given the context of small towns each of these systems will be useful in documenting the existing or non-existing economies of scale and densities associated with infrastructure development.

In addition, partly the rationale for focusing on treatment plants and distribution pipe network as a unit of analysis in the research is based on N. Pilgrim et al. (2007) findings about the NWSC management models of small towns. It is reported that due to the syndrome of oversizing systems following standard designs in serving projected demand instead of current actual demand, merely 42% of total capacity in the operational towns of NWSC is being utilized, with exception of the capital city Kampala. This is because towns are not autonomous in making management and investment decisions. utilities in secondary towns are encouraged to make appropriate decisions in respect to infrastructural development that maximize revenues while optimizing investment costs in order to have sufficient funds that can be used for expansion of services.

3.3.4. Service levels

To determine the Service levels of water supply is a complicated process in its self, many people have varying interpretations and it comprises of many indicators that vary from one context to another. In this study the working understanding of service level is a set of indicators that are qualitatively measured and when combined allows for other types of performance indicators to be defined and monitored based on existing national and international standards and practices (Patrick Moriarty et al., 2013). An explicit definition of the service levels is helpful in monitoring the extent to which performance indicators comply with the set standards of service delivery.

The performance indicators considered for study are access and reliability of services because of the strong linkage with infrastructure development and financial sustainability. Therefore for purpose of this research, access and reliability of water services is defined according to the NWSC context. Though studies in Uganda define access based on technology of service that assumes that household connections serve six people, yard taps serve twenty four people and Public stand pipes serve one hundred fifty people, this put water service coverage in small towns at 70% by 2006 (Kayaga et al., 2009), whereas reliability is considered by NWSC as having a minimum of 24/7 hours per day of water supply (NWSC PACE, 2012). Therefore service levels are qualitatively determined from bi annual performance evaluations conducted by NWSC on utilities that is measured against the National set standards and targets of 100% for access (coverage) and 24/7 hour water supply.

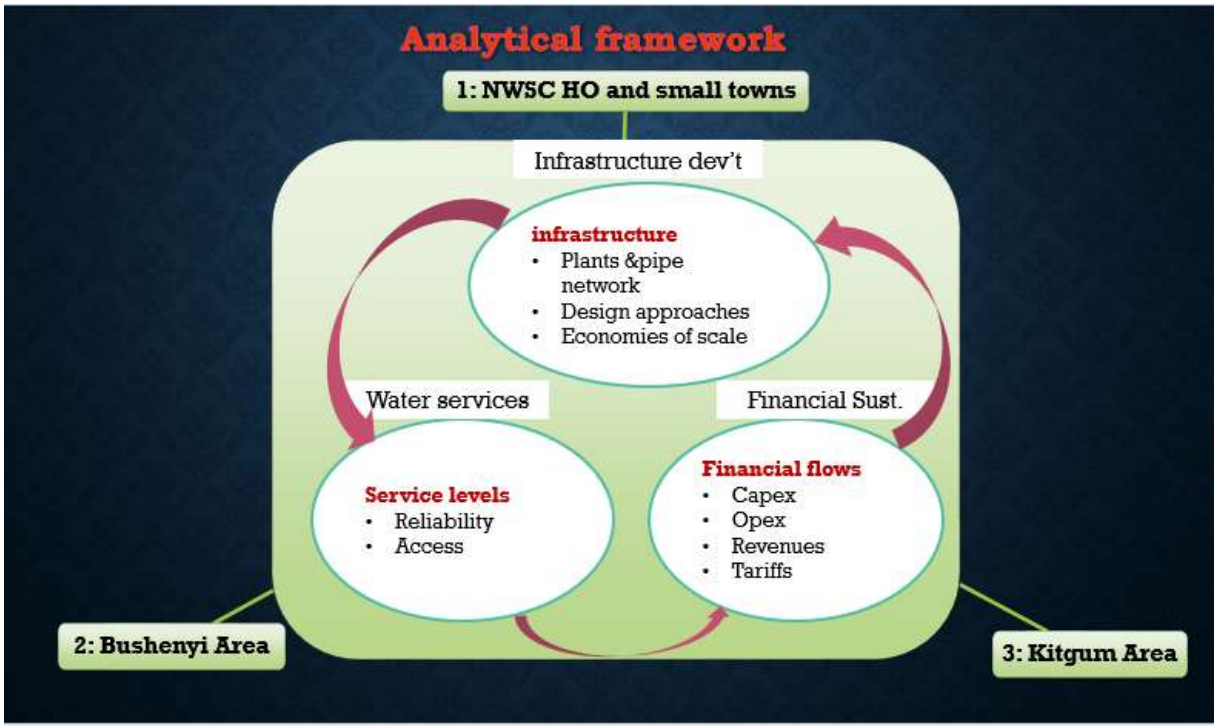

Figure 5: Analytical framework

3.4. Data collection methods

The research applied three types of qualitative data collection methods namely; semi structured interviews, field observations and secondary data collection method. Focus will be at the NWSC headquarters and triangulated with the operational two utilities. Further deliberation of these methods follow below.

3.4.1. Interviews

The aim of carrying out the semi structured interviews was to obtain a more detailed account of the topic from the interviewees in order to answer the research question which required a lot of probing, illustrations and elaborations (Hancock et al., 1998). Being that the research also aimed to gain from some expert opinions, practices and knowledge on the topic, the semi structured interview was preferred as the ideal method for the research (Harrell & Bradley, 2009). A careful selection of respondents was conducted based on their positions and direct

involvement in planning, designing, operationalizing and management of infrastructure and finances of water supply services at NWSC. The respondents included a director, senior managers and Engineers from NWSC head office whereas at the NWSC operational towns of Bushenyi and Kitgum, the respondents included the Area managers, the heads of technical, Finance and commercial sections, some technical staff were also interviewed. There were 22 respondents interviewed. A complete list of respondents is attached in the annex section of this report.

3.4.2. Secondary Data Collection

As a supplement to the primary data collection method of interviews, vast secondary data was reviewed essentially to correlate the raw data from the interviews and also to analyse the financial performance and service levels of the towns. Gain an in-depth understanding of infrastructure development policies and designs practiced in both the small towns under study and at NWSC headquarters. Quantitative Secondary materials like monthly operational reports, financial statements, annual Capex and Opex budgets, bi-annual performance evaluation reports and audited annual reports were particularly reviewed for the period 2013 to 2017 to determine the performance of the towns and was useful in answering the research questions. Further review of NWSC current development programmes, policies and action plans on infrastructure, National WSS standard design manual and government of Uganda performance contract with NWSC helped establish the state of affairs at NWSC in general and specific service delivery in the towns.

3.4.3. Observation data collection method

The observation method was used in the research to validate or nullify the interviews that were conducted (Hancock et al., 1998). The focus was observing the type and sizes of infrastructure built, the landscape of environment which pose a challenge of construction of the infrastructure, the behaviour and methods of the technicians while carrying out operations and maintenance. The reliability of service to ascertain the number of hour's water supply is available, the pressure and rate of interruption in the system. This contributed to validating the responses on service levels

3.4.4. Triangulation

In order to enhance the validity and reliability of the data collected from the field, a triangulation strategy was adopted. Triangulation technique in qualitative research is believed to be a useful strategy in reducing bias and contradictions in the findings such that only a honest suggestion about some social phenomenon can be made (Mathison, 1988). For the purpose of this research this strategy was of added value, as there was need to correlate the information obtained from observation method, the interviewees and reviewed secondary data. It was also important to validate information obtained from the NWSC headquarters with the realities on ground at the operational level (in the towns of Bushenyi and Kitgum). Also within the administrative setup of the towns, this gave a close to realistic picture.

Table 2: Summary of the Data collection methods with respect to research questions

Research Objective	Research Question	Data Required	Sources of Data	Method of data collection
To analyse how the development of infrastructure has affected the financial sustainability and service levels in the small towns of Bushenyi and Kitgum in Uganda.	To what extent has infrastructure development affected financial sustainability and Service delivery in the context of small town's water and sanitation systems?	Data on Infra development approaches Actual investment, O&M costs and revenues since FY2013/2014. Service levels on water access and reliability	➢ NWSC Hqtr & Area staff, ISDP, policies budgets & designs ➢ Capex, Opex and Rev. statements ➢ Annual reports, performance reports	➢ Semi structured interview ➢ Secondary Data collection ➢ Observation ➢ Triangulation
Specific Objectives	Specific research questions			
To examine how the current infrastructural development approaches in small town water and sanitation services have been developed. **.**	How are the current infrastructural development approaches in small towns established and who takes decisions	Data on Infra development practices, policies and designs	➢ NWSC Hqtr and the operational area staff ➢ Review ISDP & WSSP designs & policies	➢ Semi structured interviews ➢ Secondary data review
To explore the financially sustainable practices that utilities in small towns undertake amidst development of infrastructure	What are the revenue estimates generated from Capex and Opex in small town water utilities? What are practices and measurement of financial sustainability?	Data on investment costs, Opex and revenues generated. Financial indicators of financial sustainability	➢ Review of Financial reports i.e. income and expenditure statements, balance sheets, Capex & Opex budgets, staff	➢ Secondary data collection ➢ Semi structured interview
To establish how service levels suffer or not from the practices/approaches of developing infrastructure	How do the service levels suffer or not from the infrastructure development approaches of water utilities in the small towns?	Data on the Performance levels of the utilities in respect to access and reliability indicators	➢ NWSC Hqtr and the operational area staff ➢ Performance evaluations reports ➢ Annual and monthly report	➢ Secondary data collection ➢ Field Observation ➢ Semi structure interviews

3.5. Limitation of the Research

The research is only focusing on two indicators (access and reliability) for determining service levels that have a strong linkage with infrastructure development however, in water services delivery there are more than two indicators that infrastructure influences but due to the time constraint and magnitude of the work, the research will not cover all the indicators such us quality, production quantity, Non-revenue water among others

CHAPTER 4

Results and discussion small Towns and NWSC Head Office

4.1. Water sector in Uganda

The overall coordinator and policy maker of the water sector industry in Uganda is the Ministry of water and Environment (MWE) through its three directorates of; Directorate of Water Resources Management, Directorate of Environmental Affairs and Directorate of Water Development. The responsibility of providing general technical oversight for the supervision, implementation and planning for the delivery of urban and rural water and sanitation services across the country, including water for production lies with the Directorate of Water Development (DWD). DWD also regulates the delivery of water supply and sanitation to both small and large towns, provides capacity development and other support services to Local Governments, Private Operators and other service providers (NWSC annual report, 2015).

Further still, DWD through the water utility and regulation department (WURD) is authorized to regulate and monitor water authorities managing piped water and sanitation systems as specified by the water act cap 152 by use of performance contracts(M.W.E-WURD, 2018). WURD has mandated the National water and Sewerage Corporation (NWSC) as the water authority responsible for the provision of piped water supply and sanitation services in urbanized centres of both large and small towns that have been gazetted[1] The national objective of Uganda's water supply and sanitation sector is to increase urban and rural access to water supply services from 77% and 65% respectively to 100% and 79% by 2020 (N.W.S.C-SCAP100, 2016). Figure 6 shows the configuration of the water sector in Uganda

[1] Gazetting refers to the official publication of the mandate or delegated authority in the government gazette. When a small town is gazetted by declaring it as a water and sanitation supply area a new water authority is appointed by the minister of water and environment as the person or body responsible for the provision of water and sanitation services in the small town.

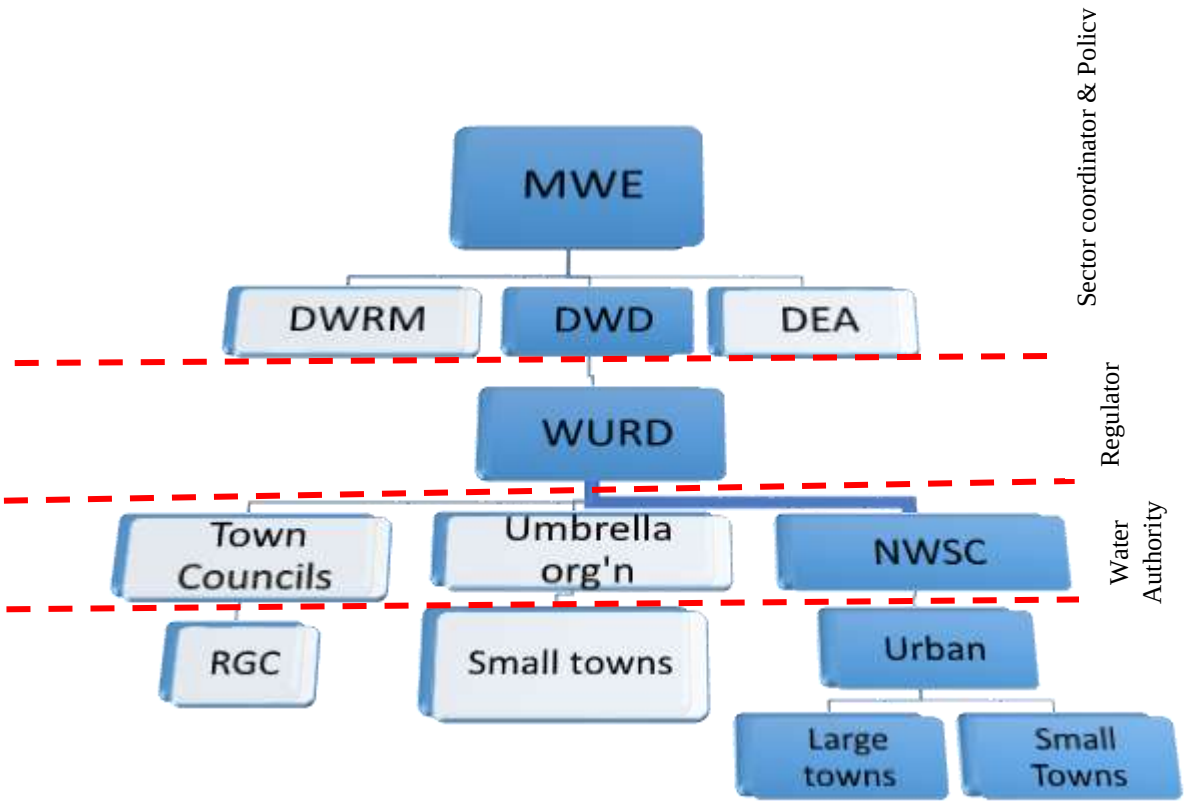

Figure 6: Administrative structure of the Small Town Sub sector in Uganda

4.1.1. Definition of Small Town's and water supply services

There exists different versions on the definition and understanding of Small Town sub sector in Uganda. For example small towns are referred to as gazetted town councils or town boards thus, with the exception of the Capital city and Municipalities considered as large towns, the rest of the urban centres are small towns (Kitonsa, 2017; Tumusiime & Njiru, 2004; Wood, 2000). Meanwhile, in the M.W.E-Manual (2013) small towns are considered as rural towns with a population size of 5,000 to 15,000 inhabitants. Although according to N. Pilgrim et al. (2007) population size of Uganda's small towns is between 4,000 to 30,000 people. Also, according to NWSC Corp Plan (2015), it suggests that towns are not only defined by the population size but rather those urban centres with a conventional water supply system in place and have been gazetted by the ministry of water and Environment for NWSC to take over the management, operation and maintenance of the water supply systems. However this categorisation of towns is not official as the MWE has continued to transfer the management and operations of the water supply systems in these towns to NWSC irrespective of their population. Therefore, population alone ceases to be a basis for the town categorization thus the current definition that acknowledges any "gazetted town council or town board as a Small town irrespective of its population and management model" holds (Kitonsa, 2017). So, where the ministry refers to small towns NWSC refers to these as "new towns".

4.2. The National Water and Sewerage Corporation Head Office

4.2.1. Background

The National Water and Sewerage Corporation (NWSC) is a public corporation entirely owned by the Government of Uganda (GOU). Formed in 1972 by decree No. 34. The corporation's legal position was strengthened by NWSC Statute No. 7 of 1995, which was later incorporated into the NWSC Act of 2000. Under the new legal framework, the powers and structure of NWSC were revised to enable the corporation to operate on a sound commercial and financially viable basis. The primary business of the Corporation as defined in the NWSC Act is to operate and provide water and sewerage services in areas entrusted to it on a sound commercial and viable basis (REEV, 2017). Further to that, as required by the performance contracts that NWSC enters with MWE, they are to provide services efficiently and economically in the gazetted towns to be able to achieve the key performance targets that are set by the MWE (GOU-NWSC-PC5, 2015). The operations of NWSC has expanded from initial 3 towns of Kampala, Jinja and Entebbe in 1972 to 27 towns by 2013. But since then the corporation has rapidly increased its operations to over 200 major urban centres across the country in a span of 5 years (NWSC-Annual.Report, 2017). The NWSC service coverage within its area of jurisdiction is targeted to expand to 100% by the year 2020.

4.2.2. Categorization of Towns

According to NWSC towns are grouped in 3 categories; Small, Medium and large towns for purposes of performance evaluation, defining the level of autonomy, the area management structure and required competencies/ capacity needed. This is determined based on the criteria of volume of business such as production (volume of water produced), customer base, Billing, Revenue collection and the complexity of the system. These parameters are preferred because it allows NWSC to create a progressive system in which towns are able to progress from a lower category to a higher category based on billing, customer base, revenue collection. This progression comes with incentives and promotions[2]. Therefore small towns according to these categorization are those towns that have a monthly billing of less than Ushs 100 million, medium towns have a billing between Ushs 100-300 million and larger/bigger towns those that are billing more than Ushs 300 million. An increase in the volume of business that matches the specific category qualifies for the town to be upgraded to that particular category. In regards to my case studies, Bushenyi/Ishaka Area falls under the category of medium towns because their monthly billing is averaging Ushs 220 million thus their performance is being evaluated against towns in the medium category whereas Kitgum Area falls in the category of small town due to their average monthly billing Ushs 70 million. Table 3 below shows an example of how towns are typically categorized.

[2] Hq3, Hq5-Respondents 3 and 5 from NWSC Head office

Table 3: NWSC-Area Categorization

No	Category	Range(Billing)	Areas	Actual Av. billing
1	A. Large Towns	Above UGX 300m/=	Jinja	1,241,732,045
2	B. Medium Towns	UGX 100m/= to 300m/=	Bushenyi/Ishaka Cluster	198,101,197
3	C. Small Towns	Below UGX 100m/=	Kitgum	53,988,932

Source: Author, analysis of NWSC performance evaluation report (period FY 2015/2016)

4.2.3. Challenges at takeover of small towns by NWSC

The continued takeover of new towns with ailing water supply systems coupled with urbanization in towns has put huge pressure on NWSC to meet the surge in demand for water and sanitation infrastructure. The main challenges in the NWSC small towns is limited network expansion, old networks, high unit costs of production, high Non Revenue water (NRW) and arrears (accounts receivables) and there are numerous reports on water shortages (M.W.E-Manual, 2013).

When a new town is handed over to NWSC, most times the water supply infrastructure is dilapidated and NWSC chooses to invest its funds to quick fix the electro mechanics, water source improvements, network reticulation and some reservoirs, then customer metering and do network intensification[3] with the hope of recouping some money from the system for sustaining supply within the town. Quite often these strategy has proved to be challenging and unsuccessful as indicated from the statements of[4]. First there is always resistance from the community to pay NWSC tariff as they consider it to be expensive, secondly there are always alternative sources of water which are free of charge like hand pump boreholes. In the first months of operations in the new towns NWSC will struggle to raise revenue for O&M of the system. Therefore, NWSC has to find other sources of funds to stabilize supply and fix supply deficits in terms of leakages, replacing old pipes etc. this implies improving the operational efficiencies of large towns in order to raise the financial resources needed to develop the infra that copes with demand to be able to sustain small towns.[5]

Uganda has a single capital city, 41 municipalities, 210 Town councils and very many Town Boards thus 24% of the population leave in urban centre (Kitonsa, 2017). There is a minority leaving in the urban areas where NWSC is mandated to provide services. Despite of progress to increase portable water supply services in towns, there are still disparities in the level of service provision in towns. The water supply systems in towns often breaks down and the water authorities have to revert to the MWE for help to sustain services. Water sales are never as high as projected by the operators because most towns have alternative sources of water like springs, hand pump boreholes and wells though often heavily polluted, thus consumers resort to use of unsafe sources. The level of infrastructure developed is low and the price of water is presumed

[3] Network intensification means- laying pipe network of sizes 1inch to 1½inch
[4] Hq1,Hq2,Hq9 Respondents 1, 2&9 from NWSC Head office
[5] Hq1 Respondent 1 from NWSC Head office

to be high. Hence, it seems towns are considered uneconomical to manage (M.W.E-Manual, 2013).

4.2.4. Roles of NWSC HO to the operational Areas

Decision making processes taken at NWSC Head office are critical for the proper functioning of the utilities in the operational areas. The Head office makes policies and regulates the operations in the areas through performance contracts referred to as Performance Autonomy creativity Enhancement (PACE contracts). Performance targets and standards are annually negotiated and agreed upon, they also have control over the pool financial accounts for the revenues collected from the areas and remit monthly management fees that facilitate the O&M of the water supply systems in the areas. Similarly provide technical support and source for funding for the development of infrastructure in the areas. Although the areas are given some degree of autonomy to make decisions in regards to service delivery and Capital development within their respective areas, for example they identify the need for mains extension, carry out the feasibility study, cost and budget for the mains extension but the powers to approve investment implementation lies with head office specifically the operations department. Annual reviews of projects proposed by areas have resulted in some projects being rejected, cut down or Area Managers and Engineers advised to postpone to the following financial years. This is due to many reasons such as financial constraints, unviable projects, unbudgeted for projects or simply projects not in the priority list. Below is a summary of the departmental roles at NWSC-HO that have a direct influence on how the operations of town utilities are conducted.

Table 4: Critical Departmental roles of NWSC HO and Small Town Utilities

Key Function	Specific Roles	Department
Monitoring and Performance Evaluation	• Monitoring and Evaluation of Corporate and Region/Area performance thru PACE contracts • Provision of quarterly comparative benchmarking data from other Areas with the overall objective of encouraging contestability among Regions/Areas; • regular customer surveys with the overall objective of protecting customers' rights and promoting customer care in the Areas, in line with the service level expectations stipulated in the customer charter • inspect, audit or conduct a survey, for purposes of ascertaining compliance with set standards	Programmes and Performance Monitoring
Operations and supervision of towns	• Financial, Logistical and Technical Support • Provision of Schedules of Tariffs, Fees, Rates and Charges • Maintains all rights of ownership in the Assets related to the provision of the Services in the Area • Maintenance of the asset register • General supervision of the towns operations	Operations/ Regional office
Rehabilitation and capital works	• Plan, Design, Fund and implement any agreed rehabilitation and Major Capital Works in the Area • Source for funding for the development of infrastructure	Planning and Capital Development
Procurement and Inventory	• Strategic support and guidance in matters of procurement and inventory and policies • Procurement Planning • Bulk procurement and stock of common inputs • Central store management	Procurement and Inventory

Key Function	Specific Roles	Department
Financial planning and management	• Strategic support and guidance in matters of financial management and policies • Computation and Payment of management fees and incentives • Payment of expenses, on behalf of the Area: VAT on billings, property insurance, ground rates, plant insurance and treatment chemicals • Provision of funds for development activities as set out in the approved Action Plan • Control and Management of pool accounts for revenues	Finance and Accounts Directorate

Source: (Kitonsa, 2017)

4.3. The development of infrastructure at NWSC Head Offices

4.3.1. General Polices of Infrastructure Development

The development of any infrastructure at NWSC is guided by NWSC policy documents, programmes and GOU policy directions and directives, GOU performance contracts which are often revised and updated[6]. Fundamental among the policy documents that steer infra development include the five year Strategic directions SD (2013-2018 and 2016-20201) and the corporate plan. An aggressive investment plan to expand services is emphasised as a priority for the corporation. NWSC stepped up its infrastructure development in early 2014, with a programme dubbed the ''Infrastructure service delivery plan (ISDP) and Water Supply Stabilization Plans (WSSP)''. These two plans entailed rehabilitation and construction of large water supply systems like (upgrading treatment plants, transmission and distribution pipe network), expansion and extension of the sewerage network and construction of Public Stand Pipes (PSP) for the pro-poor urban settlements. The objective was to augment and increase water supply access and reliability, pro-poor interventions to match the water demand for rapidly growing urban poor population in cities and small towns since the mandate to takeover more towns had increased (NWSC, 2015).

Additionally, in developing infra, NWSC has to align the infra development programmes to fit within the Government of Uganda (GOU) policies, directives and ruling government agenda. For instance investment plans are anchored on the National Development Plan (NDPII) (2015-2020) which also has an objective to Increase Water Supply Coverage in rural areas from 65% to 79% (2019/20) while ensuring at least each village has a clean and safe water source. Hence the plans support the GOU determinations to accelerate provision of safe water services to a 100% of the population specifically to the 10,600 villages in the 62 districts of Uganda (N.W.S.C-SCAP100, 2016)

4.3.2. Investment approaches for NWSC towns

Traditionally infra development has been demand driven vs supply driven approach. Supply driven was through GOU funding and its generous behaviour of promoting "water for all" methods to ensure that the majority of the population in either urban or rural have access to portable drinking water. The GOU sources for funds and gives a directive to NWSC to extend services thus whether you put infrastructure and people connect or don't connect and consume water, it was upon the consumers. The aim was to fulfil government programmes of extending services closer to the population. But today NWSC emphasize a demand driven approach, with

[6] Hq6, Hq7- respondents 6 &7 from NWSC Head office

business orientation, meaning water is supplied and sold to recoup some money to meet the costs of O&M, some depreciation and for minor investments for the sustainability of the corporation. Practices for development of infra in towns involves understanding the people to be served and their water consumption patterns, then decide on how to reticulate the network. The customer base will determines what kind of system is to be put in place.

Infra development mechanisms in NWSC is ideally cross cutting to all towns not specific for small towns, reason being that towns within NWSC jurisdiction are overseen by the same infrastructural policies, where by each town comes up with an investment plan that meets the current focus of the corporation's general investment strategy for a specific period of time. Accordingly the operational area's specific investment plans with clear milestones and deliverables need to fit within the key focus areas of the strategic direction. Cost estimates for the infra development is generated from the regional office, that provide technical support to the areas in planning, budgeting and disseminate to the areas the planned budget and each area develops budget that fits within the regional office investment plan. Due to limited financial resources, regional budgets are usually capped and each area is restricted to implement the approved budgets, although there is room for flexibility, adjustments are mainly for emergency situation for example an intervention on a water source that is drying up, main pipeline network that has been washed by floods among others. An emergency procurement can be initiated to stabilize supply as a quick fix to the challenge.

4.3.3. Politics and power of infrastructure development

Infrastructure development is also politically engineered and is inseparable from water services provisioning, neither is NWSC immune from the political influences whether at the national level or local level. The corporations' change of expansion strategy from concentrating in large towns to takeover of new towns is a strategy to tap into the political backing for infrastructure financing despite of the financial burden of operating in small towns and the challenge of meeting high stakeholder expectations (Mugisha & Berg, 2017). Indeed there is more political will to finance the development of infrastructure because there has been an increase in service coverage and given that this is the strategic aspiration of the national government. On the other hand, while allocating funds for Capex in towns, political consideration is taken into account. That is to say, towns with strong political demand are given first priority to reduce on the political pressure for demand of services. 2nd consideration is for towns with high demand for services (i.e. towns that have taken long without water services) but with less political demand for services. Hence priority is given to infra development plans/programmes that promote the interest of the GOU as a key stakeholder/partner for strategic reasons[7] Therefor these policies have shaped how infra is developed, where to develop it and who has the power to decide the beneficiaries of the infrastructure.

Growth of infrastructure is established following two approaches, when it's a big and complex project a consultant is hired to do the designs and costing. Although there are no thresholds for hiring consultants, however, the project is considered big when the estimated costs are over 10 million euros and complex when it has stringent conditions attached mainly from the powerful external funders, for example influence decisions on where to hire a consultant and contractor from, most times they are not locally sourced, funders come with own interests for instance decide on whether to build treatment plants instead of network expansion, financing conditions. If the project is medium and less complex, designs and costings are done "in-house" by NWSC

[7] Hq2- Respondent 2 from NWSC Head office

Planning and Capital Development Directorate's Engineers. The project is less complex when it has minimum conditions, easy to manage and most especially internally funded by NWSC. However much emphasis is put on "in-house capacity" to do most of the work since the expertise is available and also to minimise the cost of hiring consultants. NWSC has now adopted the initiative and designed its own first water supply systems at Kapeeka and funded it from the internally generated funds. This is just one of the many internal projects that have saved millions of shillings for the corporation[8]

4.3.4. Pre-feasibility study approach

In the identification and development of water and sanitation projects, one of the requirement in the MWE water supply design manual is that studies are conducted to assess water and sanitation coverage, the status of towns (district headquarters, counties or sub counties), populations and strategic environmental assessment (M.W.E-Manual, 2013). In compliance with the design manual requirements, NWSC while implementing the Service Coverage Accelerated program to achieve 100% coverage by 2020 (SCAP100) conducted an in-house prefeasibility study. The objective of the study was to identify and select suitable technical options that could provide a safe and reliable water supply for the villages in the project area in order for the GOU and NWSC to take a decision on the appropriate options to consider for the feasibility study (NWSC-Pre-Feseability.Report, 2016).

From the studies conducted, by June 2016 NWSC was already operating in 170 towns across 62 districts, 400 counties and in 15, 500 villages (estimated population of 14 million people) however the administrative districts are projected to increase to 80 with a population of 16.4 million using a Uganda Bureau of statistics annual growth rate of 3.03% (UBOS, 2014). The aim of the project is to have 100% coverage targeting all the unserved villages within NWSC's jurisdiction installed with 140,000 new house connections and 20,000 Public stand pipes (PSPs) by 2020, two PSPs per village and one PSP serving 200 people (N.W.S.C-SCAP100, 2016). Below is a summary of the outcome of the prefeasibility study carried out from NWSC operational areas categorised on regional basis down to the village level

Table 5: Villages with and without 100% pipe water supply

#	Region	Districts	Villages under NWSC		Villages with 100% piped Water		Villages without 100% piped Water	
			No. Villages	Population	No. Villages	Population	No. Villages	Population
1	Central Region including Kampala	21	5,200	8,256,727	1,675	5,075,765	3,525	3,180,962
2	Western Region	20	6,363	4,351,200	2,223	1,778,151	4,140	2,573,049
3	Eastern And Northern	21	3,857	3,042,347	913	1,084,726	2,944	1,957,621
4	Projected new districts/towns	18	1,391	788,368			1,391	788,368
	Total	**80**	**16,811**	**16,438,642**	**4,811**	**7,938,642**	**12,000**	**8,500,000**

Source: (N.W.S.C-SCAP100, 2016, p. 9)

From the survey 12,000 villages with estimated population of 8.5 million people are without access to reliable and safe drinking water, therefore the project aims to accelerate service

[8] Hq6, Hq7 Respondents 6&7 from NWSC head office

coverage to 100% by 2020 to these unserved villages through the list of identified technical options of infra development listed below according to their order of priority;

- Network intensification from an existing water supply system
- Pipe water extension and network intensification from an existing water supply system
- Mini potable water system
- Supply from ongoing/planned major infrastructure project

The implementation of the project has also defined the route and the type of technology that NWSC intends to undertake while extending services to a larger part of the community

4.3.5. Technological choices and standards

Installation of more water points inform of Public stand pipes (PSPs) is the preferred choice of service delivery model that is being promoted for water service supply expansion at the village level. Therefore more water points will be constructed to serve the majority of poor population in the small towns rather than the centralized system after the implementation of SCAP100 programme. Although these service expansion model has been developed to suit the characteristics of villages in Uganda where challenges of affordability for individual connections are prevalent, the majority poor live and O&M of the system challenges may crop up after the installation of the PSP in the villages, universal access to infrastructure service is doubtable because of affordability issues, thus the majority poor will still be left out (Estache, 2010). This model of expansion of service is also unpopular according to the SDG criteria for classifying access of service as it is not a safely managed improved water source compared to the preferred house hold connections (WHO & UNICEF, 2017). In NWSC house hold connection technologies are majorly preferred in the urban centres of large and small towns. Hence when serving the community "we try to match the level of service to the expectation of the community" there may be communities that are not ready for house connection but are in preference with PSP, therefore we try to meet the needs and expectation in service levels [9]

Technology to be adopted is mainly determined by the dynamics of sources of water and "optional analysis" of the technology carried out. If it's an NWSC funded project the cheapest and cost effective options are preferred while other funders may dictate on the choice of technology", there are towns that have gravity schemes, ground water, surface water and already existing bigger water supply system. These are all taken into consideration and the cheapest optional technology is adopted. External funders often prefer very expensive but sustainable technological options such as gravitating water from reliable surface water sources using bigger pumping mains to augment water supply in the small satellite towns rather than drilling boreholes. Therefore, there is no standard technology, every technology adopted responds to challenge on ground e.g. if the raw water has a lot of iron and manganese, you may need to put in aspects like aerators which is different from when you extracting water from underground but with less manganese and iron removal[10].

On the other hand, as a guiding tool in developing the designs for the pipe network in towns, the Area Engineers are also asked to use the Ministry of Water and Environment standard water supply design manuals and adhere to NWSC standards. But, the national standard design manual mainly focuses on the water supply systems of the rural areas and the urban areas, for instance, The per capita consumption used on the rural areas are 20 l/day for population up to

[9] Hq3 respondent 2 from NWSC Head office
[10] Hq6, Respondent 6 from NWSC Head office

5,000 persons, 35 l/day for medium towns up to 20,000 persons and 50 l/day for the larger towns (M.W.E-Manual, 2013, P. 2-4). Bushenyi and Kitgum areas falls neither of the above categorization, being a towns with transitional growth, with a population of over 40,000 people(UBOS, 2014). Therefore designing the pipe network based on the above consumption patterns may be misleading and leads to over sizing of the pipes which results to construction of expensive systems thus increase in O&M costs of the system (Lauria, 2003)

4.3.6. Economies of scale and Densities of Infra Development

The Engineering approaches of developing infra in small towns differs from those in large towns. When we take for instance, "In Kampala we're talking about big volumes of water to be abstracted (with large diameters of pipes and huge treatment plants) for bigger population densities with higher demand thus preference for centralized systems to benefit from the economies of scale"[11]. Whereby the unit cost of producing water in Kampala was 1,961shs/m^3 which is much lower as compared to Bushenyi/Ishaka at 3,236shs/m^3 and Kitgum 3,530shs/m^3 for FY 2015/2016 respectively, for the reason of large differences in the volumes of water being produced and the customer base. In small towns the population densities are low, even if the borehole yields were too high, with other standby boreholes which are sufficient you cannot use very big sizes of pipe. They require micro infra suitable for the small populations.

The unit cost of production as defined by NWSC is the average cost incurred to produce a cubic unit of water in a water supply system. These costs includes all the operating and depreciation costs (NWSC annual report, 2015). From the analysis of NWSC's annual water production figures against the operating expenses plus depreciation for four financial years (FY2013/2014 to 2016/2017) reveals that the cost of producing a cubic unit of water in a large town/city like Kampala is almost 2-3 times lower than the cost of producing water in the small towns. This finding is consistent with other studies which show that bigger utilities have a much lower unit cost of production and greater performance as compared to smaller utilities (World.Bank, 2017)

In the FY13/14 the unit cost of production of water in Kitgum town was Ushs.5, 429/m^3 with a total volume of water produced of 172,172m^3/year. Bushenyi area's unit cost of production was relatively lower at Ushs 3,371/m^3 to produce 538,670m^3. In the same financial year Kampala city's unit cost of production was at Ushs.1, 625/m^3 producing 63 million cubic meters of water. The big disparity in the costs of production is as a result of high economies of scale and densities of water supply in large towns where the infrastructure is well developed that can produce huge volumes of water, rapid increase in the number of connections due to speedy population growth, urbanization and increased operational efficiencies. Scale economies are still low in the small towns, they have low connectivity levels, fewer customers and limited network expansion. Table 6 below illustrates the performance trend of KPI's used to determine the unit costs of production of the large town/City utility (Kampala Water) against the small town of Bushenyi and Kitgum

[11] Hq1 Respondent 1 from NWSC Head office

Table 6: Performance Trends of NWSC Kampala water and the Small Towns

KPI's	Kampala Water				Bushenyi/Ishaka				Kitgum			
	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 13/14	FY 14/15	FY 15/16	FY 16/17
Water Produced '000'(m3)	63,833	63,802	66,306	77,201	539	712	1,187	1,211	172	316	337	307
Operating Exp. (million)	103,722,	119,186	130,039	113,252	1,825	2,806,	2,842	3,353	935	1,163	1,190	1,142
Unit cost. (ushs/m3)	1,625	1,868	1,961	1,467	3,371	3,939	3,236	2,770	5,429	3,678	3,530	3,722
Network Expansion (Km/yr.)	116	153	161	271	68	90	76	25	*13*	*10*	*6*	3
New Con,/yr.	15,324	14,982	18,951	22,862	408	1,027	1,097	787	529	574	233	329

Source: Author's analysis of NWSC Performance from audited annual reports 2013 to 2017

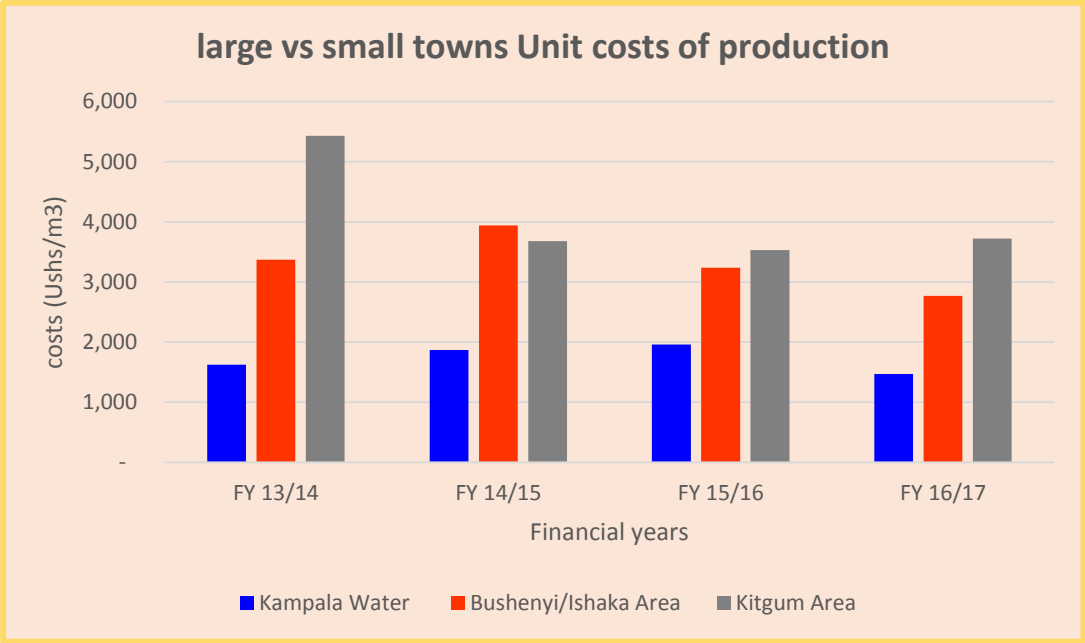

Figure 7: Analysis of Unit cost of production large and small towns

It should also be noted that in the FY2013/2014 when the unit cost of production for Kitgum town was incredibly highest, that's the period when NWSC took over the management and operations of the water supply system of Kitgum town more (details 1n chapter 5). This is also an indication that on takeover of a new town the unit cost of production is certainly higher but with the possibility of cost savings from the aggregation and subsequent revamping of the infrastructure within the town, the unit cost of production will progressively decline in the following years as observed, although it is not straightforward that with the aggregation the unit costs will decline (World.Bank, 2017). However, it has encouraged NWSC management to cluster more towns so as to benefit from economies of scale, for example administrative scale economies, "instead of having an engineer for each town, we have one engineer managing over 5 towns in a cluster form. Therefore his salary is economically spread across the towns. Thus management proficiency is what is sustaining the operations of these towns"[12]

[12] Hq1 Respondent 1 from NWSC Head office

4.4. Perspective of financial Sustainability at NWSC HO

The aim of NWSC in general is to strive to be a viable institution to sustain service delivery. Therefore towns are also urged to generate revenue from water sales that is sufficient to meet operational and maintenance expenses (Opex) only with some surplus that is ploughed back for Capital investments. This is the understanding of being financially sustainable in the NWSC context. Surplus here is referred to as the net profit after depreciation and interest deduction. Though, NWSC doesn't often use the term financial sustainability because it means full cost recovery of O&M and Investment costs and yet it is not the case. There attempts to use a phased approach in imparting financial sustainability in towns is one way of pushing towns to move one step at a time in the strive of being self-reliant. For example on "takeover of a small town that cannot cover its employee costs, a target is given, within six months of operations to be in position to generate enough revenue to at least cover its employee costs, then moved to Energy costs (Electricity and Fuel). Then may be in the next one year they should be able to cover all the O&M costs"[13]

4.4.1. Measurement of viability of NWSC towns

Key Financial indicator used to measure the viability of NWSC towns is working ratio; which measures whether the billing of a town is able to recover all its operational costs excluding capital expenditure calculated as Opex divided by the billing of that Town. which means "the lower the ratio the better, a ratio greater than 100% means that the town is not breaking even (not viable), at 100% implies it's just breaking even and a ratio below 100% indicates that the town is making more money than its expenditure" (viable town). The table below shows NWSC's working ratio performance for the period FY2012/13 to 2016/2017

Table 7: Working Ratio Performance of NWSC global, Large and Small Towns from FY2013 to 2017

Working Ratios "%" (WR)

Financial years	**FY 12/13**	**FY 13/14**	**FY 14/15**	**FY 15/16**	**FY 16/17**	**Av. WR**
NWSC Global (%)	80	83	96	84	78	84.2
Break Even Point (%)	100	100	100	100	100	100

Source: Authors analysis of the NWSC Annual Reports (FY2013 to 2017)

For the period under review, NWSC at a global scale has generally been a viable utility because the average working ratio of 84% is below 100% (the breakeven point) this enables NWSC to cover all the O&M costs across its towns. Refer to chapter five for more detailed analysis of working ratios for the case study towns of Bushenyi/Ishaka and Kitgum.

Following these calculations, NWSC argues that small towns can be viable in the long run with the identification and development of the right investment needs. To substantiate the argument, "from NWSC experience, they have taken over towns before that were claimed not to be financially sustainable for example (Arua, Bushenyi and Soroti), by the time we took over they were very small towns, Bushenyi had about 500 accounts and billing about Ushs 5m, Arua had 1,000 accounts and billing Ushs 3m but with the right investment[14] put in these towns Arua,

[13] Respondent 3 from NWSC Head office

[14] 'Right investment' is referred to mean appropriate investment for towns with high impact for example network intensification

Bushenyi and Soroti are billing about Ushs 230m"[15]. By investing in these towns, you increase coverage and more people get connected and pay for services. Although it is appreciated that this is a process which takes a long time but with right investments, towns can become viable.

4.4.2. Relation of Financial Sustainability and Infrastructure in towns

During takeover, most towns are not viable but NWSC revamps infrastructure in these towns with the objective of making them self-sufficient[16]. The viability of these towns is enhanced through expansion of the distribution network to increase the customer base through new connections, increase production capacity through water systems upgrade and rehabilitation to guarantee reliability of supply and optimising the operational costs (NWSC-SD, 2016). Due to low levels of connectivity in the new towns taken over by NWSC, a strategy has been devised to enhance the viability of the new towns by ensuring an expansion of the distribution network by 5km annually in each of the new towns taken over. This is a policy to achieve the strategic priority area of financial growth and sustainability (NWSC-SD, 2016).

What is emphasized, is for utilities in towns to invest in highly impacting projects with less costs in order to widen coverage and grow the area. For example, if the area is to expand the network by laying 10km of either 2inch (DN50) pipe or 4inch (DN100 or 150) pipe size, "between large diameter, medium diameter or small diameter pipe sizes, which one is sustainable and highly impacting to lay for the 10km?" what is highly impacting and sustainable is the small diameter pipe size, submains extensions[17] to reach many people to increase billing[18]. Even the Allocation of Capex is directed to high impacting projects especially network intensification with small diameters of pipes that can easily be extended to many people at a lower costs.

4.4.3. Financial flows at NWSC for infrastructural growth

NWSC uses a cocktail of sources for financing investments in the small towns but most notably is through GOU investment subsidies, internally generated funding thru tariffs, cross subsidies, infrastructure fund and loans and grants form development partners. Given the critical need of investments in towns and increase in demand for services, these sources of funding is still insufficient as according to statements from[19]

4.4.4. Tariff structure analysis

The corporation has a uniform tariff structure that is applicable to all the towns under its jurisdiction, the reason behind is to promote equity in water pricing. The tariff structure comprises of four categories of; Domestic, commercial, Institutional and Public stand pipes (PSP). Whereby each category has a different tariff band (NWSC annual report, 2015). When the tariff structure of NWSC in general as the national utility is critically examined for the last four financial years (2013 to 2017) against the unit cost of production of water. It shows that the weighted average tariff[20] has been generally higher than the unit cost of production. This implies that the tariff alone in general is able to cover the O&M costs of the water supply and

[15] Respondent 3 from NWSC Head office
[16] Hq4 Respondent 4 from NWSC Head offices
[17] Submain extensions refers to a pipe network with pipe sizes of 2inches
[18] Hq1 Respondents 1from NWSC head office
[19] Hq4,Hq3,Hq2,Hq1 Respondents 4,3,2,&1 from NWSC head office
[20] Weighted average tariff (WAT) is referred to as the average tariff for the four categories (Dom, Com, Inst and PSP) but weighted using the volume of water sold per category. Calculated as; $WAT=\frac{water\ sold\ Domestic}{Total\ water\ sold}(Dom.tariff)+\frac{water\ sold\ Commercial}{Total\ water\ sold}(Com.tariff)+\frac{water\ sold\ institution}{Total\ water\ sold}(Inst.Tariff)+\frac{water\ sold\ PSP}{Total\ water\ sold}(PSP\ Tariff)$

sewerage systems and remain with some operating surplus that is ploughed back for investing in infrastructure in the needy towns as illustrated in Fig.8

Table 8: NWSC Global tariff and unit cost of production trends

Financial Years	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17
Unit Costs of Prod (Ushs/m³)	1,672	1,852	2,137	2,271	2,083
Weighted average tariff	2,115	2,422	2,263	2,668	2.855

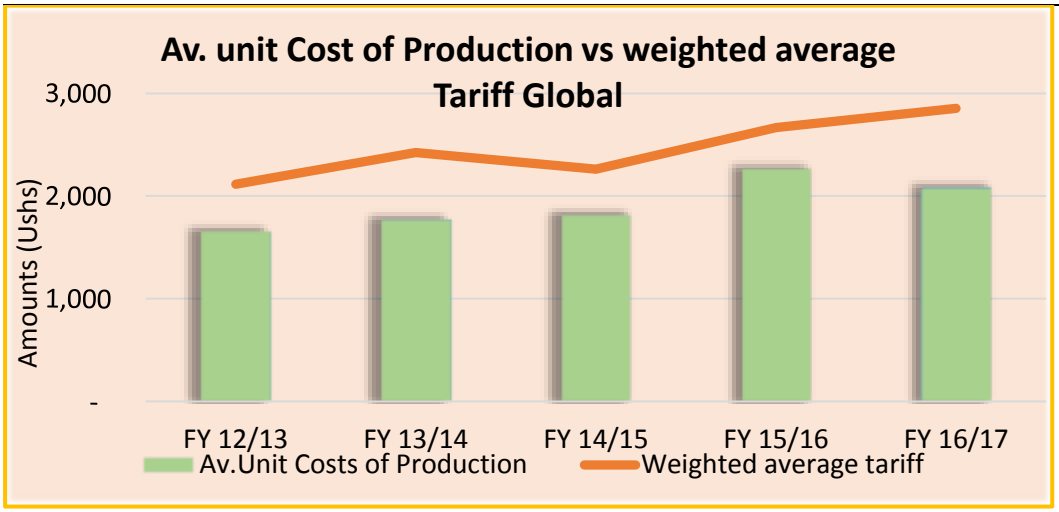

Figure 8: NWSC tariff and unit cost of productions performance trends.

The tariff is covering across board the operational expenses plus depreciation hence, it is not a full cost recovery tariff. In the NWSC-Annual.Report (2016), it was stated that, at full cost recovery tariff charges (i.e. O&M and investments costs), the price of water would have to increase by more than 100% across the tariff categories, the full cost recovery tariff was estimated at Ushs 5,408 in the FY 2015/2016. This would be quiet expensive for majority of the ordinary citizens to afford as supplemented by[21] who said "If the tariff was made to recover all costs then water would not be affordable". However, on a town by town basis tariff analysis, you find that even the O&M recovery cost tariff charged, in some towns doesn't cover all the operational expenses because the cost of operation is so high. But in large towns where there are huge economies of scale the tariff is able to recover O&M costs, depreciation and generate some operational surplus that is used to finance small towns Opex as highlighted earlier. In the next chapter, I will be able to analyse the tariff structure of the case study towns of Bushenyi and Kitgum.

4.4.5. NWSC cross Subsidy model

The Corporation has also instituted its internal cross subsidy mechanisms in its operational areas for sustainable delivery of services. This is where by the surplus generated from the operational efficiencies of medium and large towns are used to cross subsidize the investments and operational expenses of small towns water supply systems. From the analysis below of the Towns viability, reveals that the towns of Bushenyi/Ishaka and Kitgum had a higher unit cost

[21] Hq2 Respondent 2 from NWSC Head office

of production than the weighted average tariff from FY 2013 to 2016. The implication of this is that, the operational costs from this towns cannot be recouped by the tariff only, therefore their operational costs have to be subsidized by the large towns that have surplus income generated as a result of lower unit costs of production as shown in fig 9.

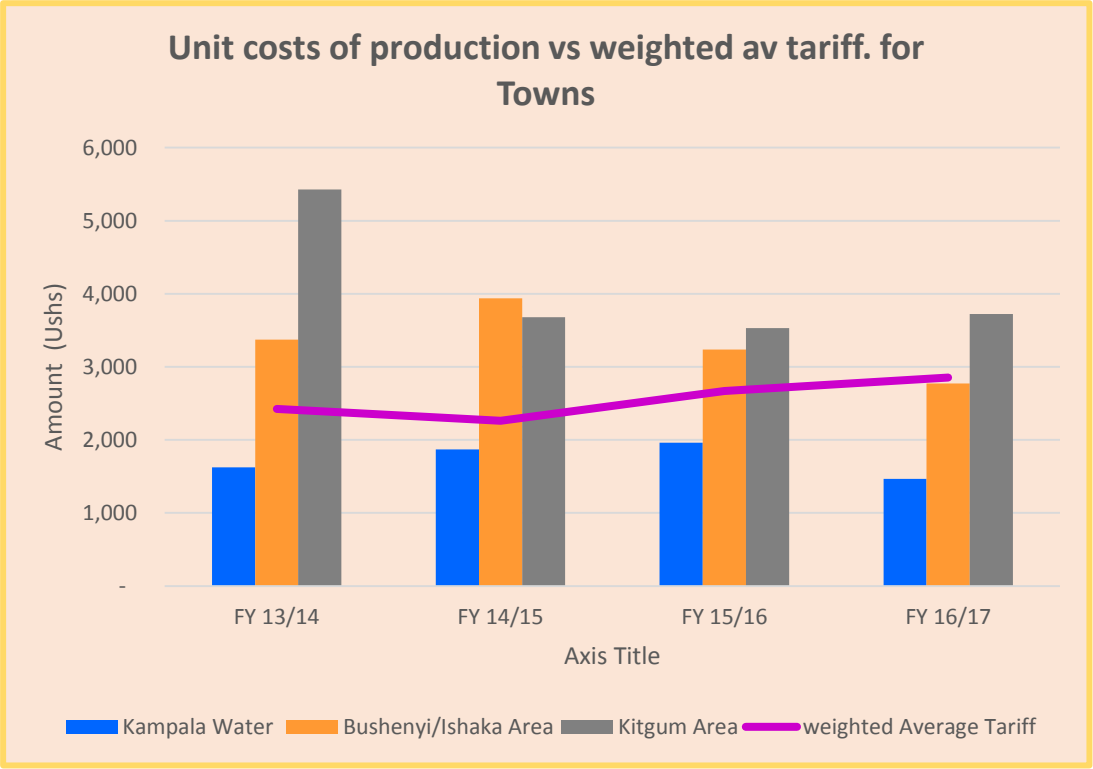

Figure 9: NWSC cross subsidy model of for small towns

So the deficits in O&M costs are covered from the utilities that are able to generate surplus such as Kampala water, Jinja, Mbarara and Entebbe. Surplus from this large towns is managed centrally at NWSC head office and is ploughed back for investment in other towns that are not breaking even, this is how the large towns subsidize the small towns. The cross subsidy model has enabled NWSC generate funds to finance its own projects, a typical example is the ISDP and WSSP programme which was being implemented across all the operational towns of NWSC. This programme was funded 100% by NWSC internally generated funds, majorly from the surplus of big towns (NWSC, 2015)[22]. However, the small Towns are expected to cover O&M costs, these costs according to NWSC include Employee related costs, Premises maintenance, static plant maintenance, pipework maintenance, transport and mobile plant, supplies and services and establishment costs but most of them are small and cannot meet these costs therefore they are highly subsidized. The Operational expenses of towns is critically examined in the next chapter specifically for the case study towns.

To supplement the cross subsidy model and casting the net wide for sources of funding for infra development NWSC has also established an "infrastructure fund" to meet the short and long term infrastructure investment needs in its operational towns. This funds enable to build a strong

[22] Hq4 Respondent 4 from NWSC Head offices

financial foundation for the corporation that easily ties with the capital markets funds either at national level or internationally. The infrastructure fund is designed in such a way that there is significant contribution from the new connection policy which requires the rich category of customers pay for their individual connection to facilitate NWSC install more free Public Stand Posts. Additionally, the tariff adjustment of 10% usually implemented over two years also contributes to the infrastructure fund (Mugisha & Berg, 2017). Once the resources have been secured they are "ring fenced" and specifically utilized for Capital development projects. NWSC is also desirous to venture into market financing of its investments as indicated in the policy documents NWSC-SD (2016), as one of the strategic priority areas to explore for financial growth and sustainability however, the initiative has not been strongly developed. Therefore there is heavy reliance on the traditional means of financing infrastructure which include revenues from water sales, GOU subsidy and through development partners.

4.4.6. GOU Investment Subsidy

Infrastructure development at NWSC is highly subsidized by GOU through the investment subsidies stipulated in the performance contracts agreement between GOU and NWSC. As part of GOU responsibility and obligation towards expansion of services, the government has a responsibility to source and fund major investments in water and sewerage projects, contribute towards infra development in all the new towns taken over by NWSC and shoulders costs of investments deemed to be of social nature (GOU-NWSC-PC5, 2015). For instance, the SCAP100 programme currently being implemented is cost shared between NWSC and GOU. The GOU is contributing Ushs 22.5 billion (48%) and NWSC is contributing Ushs 42 billion (52%) towards project implementation in the financial year 2017/2018, this is a three year project[23]. Accordingly, the GOU has already fulfilled its commitment by depositing all the funds to NWSC for procurement of pipes.

As a buffer, the GOU every financial year provides NWSC subvention fund amounting to Ushs 3 billion specifically for the development of infrastructure in the new towns, the criteria for allocation of the funds to the towns is at the discretion of NWSC. However, today, the towns have become so many, the amount of the grant from the GOU has remained unchanged since 2013, and therefore the proportion per town has reduced as proclaimed[24]. So, the Subsidy given for Capital expenditure (Capex) to improve on network expansion is insufficient, consequently stagnating access to water supply services at 71% since 2016 (M.W.E-SPR, 2017). Principally, government plays a fundamental role in the development of infrastructure in the new towns.

Development partners as external funders for most major water and sanitation (Watsan) projects are equally instrumental in how infra is developed at NWSC. Once there is a critical need for a Watsan project to be developed, the GOU can take a loan from the development partners like World Bank and then on-grants it to NWSC as subsidy or sometimes NWSC directly takes investment loan from the local or international banks to finance its investments. P&CD directorate at NWSC then prepares proposals and submit to different funding agencies such as World Bank which is currently financing projects in Bushenyi, Arua, Gulu, KFW financing investments in Gulu and Kampala, AFD Watsan projects in Kampala[25]

[23] Hq1-Hq9 Respondents 1 to 9 from NWSC Head offices
[24] Hq4,Hq5,Hq9 Respondents 4,5&9 from NWSC Head office
[25] Hq6,7,8&9 Respondents 6-9 from NWSC Head offices

4.5. Service Delivery beyond boundaries

In its quest for raising the level of service provision, NWSC is extending the distribution pipe network beyond its areas of jurisdiction that was restricted to only the urban centres as defined by the act, but now are extending services to the peri urban, sub counties and villages through its internal programmes. However, it is not only for raising service delivery levels but also increasing the customer base who in turn pay for services and widen the financial basket for the utilities through increased revenues for "better service" provisioning. By better service it means, more supply reliability, a more steady functionality of water production system, increased network expansion resulting to more new connections in the towns, increase in attention to the poor, stakeholder engagement and more opportunities for encouraging accountability (Mugisha & Berg, 2017).

4.5.1. Struggles in providing Uniform service delivery across towns

NWSC also while developing infra strives for uniform service provision and high customer satisfaction levels across its operational towns with defined standards regardless of the size and viability of towns. That is to say, the quality of service received by a consumer in Kampala is expected to be the same kind of service received by a consumer in Bushenyi, Kitgum and Moroto (small towns) as stated by[26]. Therefore, there is not supposed to be discrimination in service delivery based on viability and sizes of towns. Things like, a consumer in Bushenyi or Kitgum is supposed to receive blue water because they are not financially sustainable while in Kampala they receive good quality water because they are viable are unheard of[27]. This is a strategic objective of NWSC but it is not an easy task as outcomes from the customer satisfaction surveys (CSS) conducted by NWSC programmes and performance monitoring department to measure the level of satisfaction on the services provided by NWSC reflects contrasting results. This is an indication that it's difficult to provide services at a uniform level. The level of satisfaction on the quality of services varies from region to region and town to town as illustrated in the figure below

[26] Hq3 Respondent 3 from NWSC Head offices
[27] Hq3, Hq5, Hq7 Respondent 3,5 &7 from NWSC Head offices

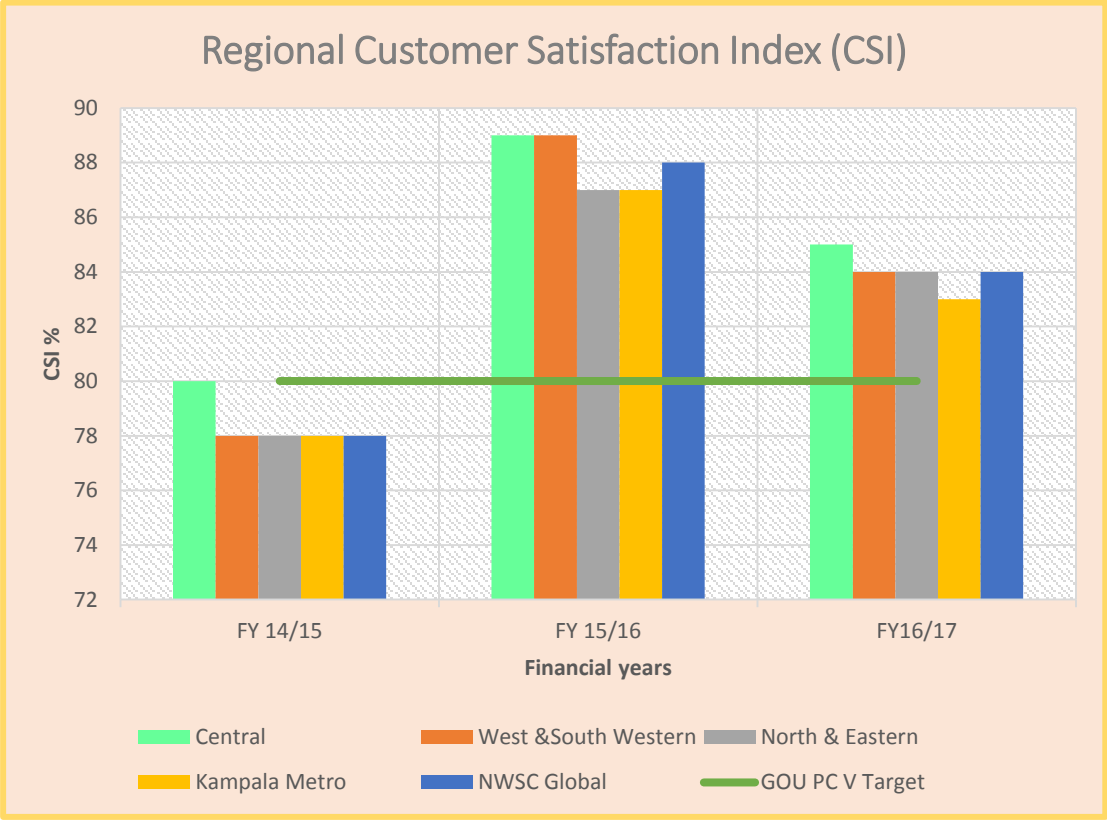

Figure 10: Analysis of the NWSC regional CSI from FY 14/15 to 16/17

The analysis of the CSS reports for 2015 to 2017 shows that NWSC performed above the minimum standard of GOU performance contract of CSI target of 80% in the past two years but fail short of achieving the target in the FY 14/15. Although it is argued that the decline resulted from the methodical changes in the survey (NWSC-CSS.Report, 2015). At the regional level CSI varied from region to region though above the minimum standard. Therefore the service provision cannot be uniform.

4.5.2. Challenges of providing services

Despite of the efforts and steps taken by the organization to enhance service delivery in towns quite often services have continued to suffer. Sometimes services suffer in towns due to the internal bureaucratic processes of delay in procurement and delivery of pipes for network extensions resulting from financial constraints[28]. In the Managing Directors' (MD) message, it's acknowledged that during the FY 2016/2017 one of the key challenges that NWSC encountered was of limited infrastructure financing in the wave of increased demand for service delivery. However by the end of the same financial year, the corporations had made a profit of Ushs 70 billion which is ploughed back for investments to improve services like network expansion as being implemented currently in towns (NWSC-Annual.Report, 2017). Therefore one can assume that once the utility is financially strong, the level and quality of services proportionally goes up but one needs to be aware that there could be some management challenges that will hinder the utilities in towns to achieve that.

[28] Hq8, Hq9 Respondent 8&9 from NWSC Head offices

4.5.3. Definition of access/coverage for towns

The measurement of service coverage/access at NWSC is still vague though from (NWSC-Annual.Report, 2016, 2017; NWSC annual report, 2015) water service coverage is computed as the percentage of the population served over the target population. But for a geographical service area to be considered to have 100% coverage it has to have all the pipe network in place that is, the mains extensions, submains and intensifications. The Areas that are not fully covered are those with only mains extensions but without intensification network to reach out to all the villages. Take for example, 'the city centre of Kampala has 100% access because it has all the pipe network, 15km off the centre is 85% access and 30km away drops to 70% due to lack of intensification pipe network" therefore access is a hybrid of events Hq1, Hq5, Hq6. Others define coverage based on the interpretation from SCAP100 programme that aims to achieve 100% service coverage by 2020 by having at least two water points for each village within NWSC jurisdiction and each water point serving 200 people within a reasonable walking distance of 0.5km. by having two water points in each village means, that village is 100% covered or has access to water services (N.W.S.C-SCAP100, 2016)[29] .

4.5.4. Impact of infra growth on service levels of access

Eestimates for the last five years show that NWSC service coverage has steadily been on the rise from 77.8% in 2013 to 78.8% as at 30th of June 2017. Although the increase in the service coverage is mainly attributed to rapid expansion of the network but also the rapid geographical expansion of the service area (191 towns taken over since 2013) has significantly contributed to increased service levels. However the service coverage level is mostly low in the new towns due to low connectivity (few connections) and limited pipe network (NWSC-Annual.Report, 2016, 2017; NWSC annual report, 2015)

Almost all the respondents acknowledge that Infrastructure growth has had immense effect on the magnitude of people accessing water supply services. "Feedback from the consumers show that the investment in water system has had significant impact in terms of access, more customers have been connected, and there has been tremendous improvement in the hours of supply in towns, quality of water and all these vary from time to time"[30]. Considering 3 key performance indicators of water network expansion, total connections and new connections per year measure the level of service expansions at NWSC, reflect a direct relationship (Mugisha & Berg, 2017). The aggressive growth rate of 962% of network expansion in the past five years (2013-2017) as depicted from the table has translated into close to 100% increased number of new connections per year from the base year of 2013, this is an indication of the significant role development of infra has on access of services.

Table 9: NWSC KPI's for expansion of services

KPI	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	% growth
Network expansion (Km/yr.)	86	470	1,448	888	911	962
New Connections per yr.	21,637	28,068	34,165	38,836	43,214	100
Annual total connections	317,292	366,330	415,838	472,193	529,402	67

Source: Authors analysis of NWSC audited Annual reports for FY12/13 to 16/17

[29] Hq2, Hq7 Respondent 2&7 from NWSC Head offices
[30] Hq3 Respondent 3 from NWSC Head offices

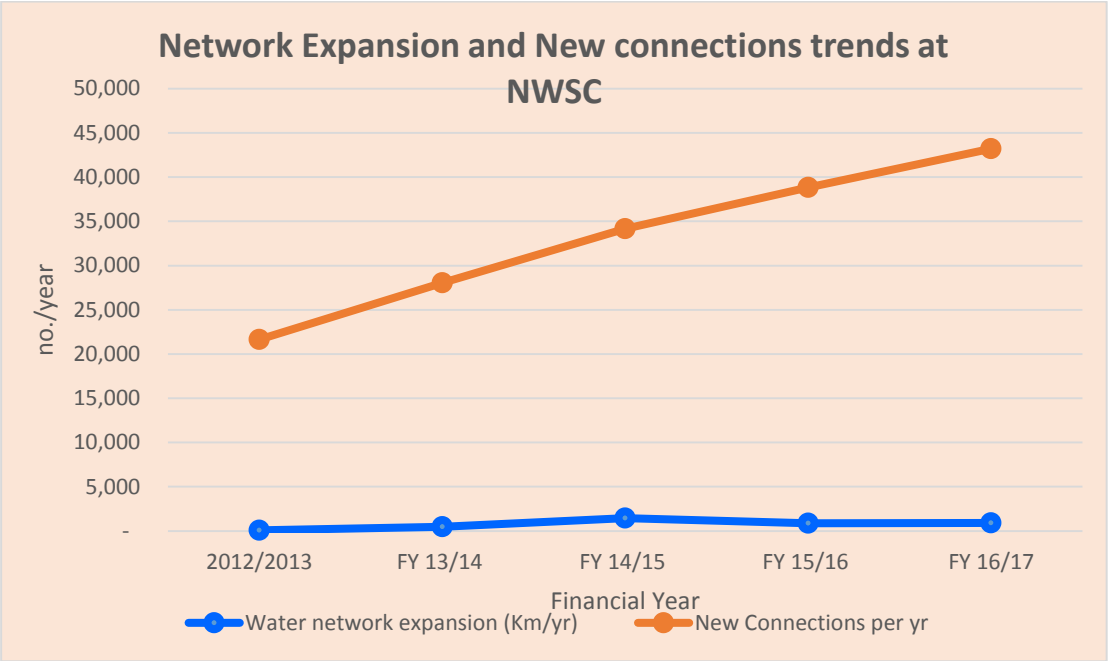

Figure 11: Five year trend of network expansion and new connection.

On the contrary, this direct relationship of infra development and increase in new connections that increases access is assumed to be applicable only to the water supply systems, even then its proportionality is challenged. "The direct proportionality of infra development to improvement in access is a yes and no answer because often investments have been done but people do not apply for connections e.g. sewerage infrastructure because the cost of connections are high[31].

4.5.5. Predicaments of Service reliability in towns

Service reliability is measured by the average number of hours in a day with water supply service and according to the target and standard of NWSC is supposed to be 24hr water supply (NWSC-KPI.Report, 2017)[32]. It was challenging to obtain reliable information in regards to the global level of reliability of services at NWSC as this indicator is not often monitored and evaluated on by the programmes and performance monitoring department. Nonetheless, there is a general belief that service reliability has improved greatly in the new towns that NWSC has taken over because budgets are re-allocated to prioritize water stabilization plans, they have rehabilitate water supply infrastructure and establish new sources of water by drilling more boreholes. A case in point is, "Kumi and Palisa towns taken over in 2017 never used to have water completely but now they have water for 3hrs to 12hrs for a day"[33]. Thus providing water on a 24hr supply is still a myth in some towns because during drought (dry season), some sources of water like ground water abstraction in northern Uganda is greatly affected, the boreholes are drying up even the surface water is lowering like for the case of Bushenyi/Ishaka.

[31] Hq6 Respondent 6 from NWSC Head offices
[32] Hq2 Respondent 2 from NWSC Head offices
[33] Hq2 Respondent 2 from NWSC Head offices

Even towns with 24hr supply have dry zones amidst them. These affects the ability of the utilities to provide services regularly[34]

The closest attempt that NWSC has undertaken to determine the level of service reliability in towns in relations to the rapid development of infrastructure is through customer satisfaction surveys. In the surveys, NWSC has listed a number of service attributes which its customers demand for and among them is the "water supply reliability and sufficient supply pressure". From the results of the annual surveys conducted from 2015 to 2017, the NWSC global performance shows that the customers were least satisfied with supply reliability and sufficient pressure an indication that water supply services were not being provided on a 24hr supply despite the aggressiveness in infra development in towns (NWSC-CSS.Report, 2015, 2016, 2017). The majority of the complaints raised by the customers was related to supply reliability and low pressure. In fact, in the CSS report of 2017 unreliable water supply problem accounted for 25% of the criticisms raised out of the total respective attributes.

General opinions of the staffs interviewed is that towns have improved service delivery largely due to the financial support from NWSC Head office for capital investments to increase coverage/access and short term interventions to improve on the supply reliability. From the struggles of being financially sustainable resulting from low economies of scale and densities, certainly if the towns were not getting any financial support from Head office, then the levels of services would have deteriorated, as they would not be in position to expand the network or upgrade water sources so really these two depend on each other. If towns are to improve service levels of access and reliability on their own, then they need to raise the level of their operational efficiencies, aim at being self-sufficient to cross subsidize each other.

[34] Hq1, Hq2. Hq4, Hq8, Hq9 Respondents 1,2,4,8&9 from NWSC Head office

CHAPTER 5

Transformation of services in the Towns of Bushenyi/Ishaka and Kitgum

Service provision in the towns of Bushenyi/Ishaka and Kitgum have continuously been transformed since 2013 when NWSC reformed its operations to focus more into a broader aspect of service delivery through geographical expansion and rapid development of infrastructure. All in strive for sustainability and improvement of the water supply system to meet the ever increasing demand. NWSC has taken bold steps of increasing access of services through a swift takeover of new towns and rapid growth of infra. We shall first discuss the evolution of service delivery in Bushenyi/Ishaka town then later on Kitgum town.

5.1. Rapid Infrastructure growth and geographical expansion of Bushenyi/Ishaka Area.

NWSC took over the management and operations of Bushenyi Town council water supply system from the urban water authority in 2002. Since then the Town council was elevated to municipal status in 2010 with the annexation of Ishaka town council plus some parishes to form the Bushenyi/Ishaka municipality (Bushenyi-Ishaka.Municipality, 2015). This also gave birth to NWSC Bushenyi/Ishaka operational Area. The area has been implementing Infrastructure service delivery plans (ISDP) since FY 2013/2014 that has seen a fast growth of the pipe network to expand service and continuous takeover of new towns to increase geographical coverage. More 10 towns of Kabwohe, Bugongi, Rubirizi, Kitagata, Kabira, Kashenshero, Mitooma, Rutookye, Kyabugimbi and Buhweju have been added to Bushenyi/Ishaka operational area as the main administrative Centre to form what is commonly known as "Greater Bushenyi/Ishaka Cluster". As a cluster the total pipe network has grown tremendously from 193km in FY2013/2014 to 561km at the end of FY2016/2017 registering a growth rate of 191%. This network serves 9,621 with the total annual billings and revenues of Ushs 2.6 and 2.5 billion respectively.

5.1.1. Increased Coverage/Access

With the rapid growth of the mains extensions and intensification of distribution pipe network accessibility/coverage level of services has improved greatly in Bushenyi/Ishaka and it's estimated at 80% within the municipality. Although the general target of NWSC is to increase coverage to 100% by 2020 through the SCAP100 programme. Some factors that have hindered the utility in Bushenyi to achieve 100% coverage as per now include; commitment to invest was low due to insufficient return to investment from the town, some water schemes are still under the district authority, sparse population on hilly areas but since there is commitment now to carry out more investments there is optimism of achieving 100% coverage[35]

Improved levels of access to services resulting from investment in mains extensions, intensification and geographical expansion through takeover of new towns has seen

[35] BI1, BI2, BI4 Respondents 1, 2 & 4 from Bushenyi/Ishaka Area

Bushenyi/Ishaka area rapidly increase its customer base. The total no of connection has more than tripled from 2,595 connections in the FY 2013/2014 to 9,621 connections by the end of FY 2016/2017 representing 271% growth in the customer base. Annual average new connections made has also doubled from 408 connections per year in 2014 to 830 connections per year in 2017 translating into a growth of 103% (Bushenyi/Ishaka.Area, 2017 ,2014, 2015, 2016). The new connection performance trend for Bushenyi/Ishaka area is presented below

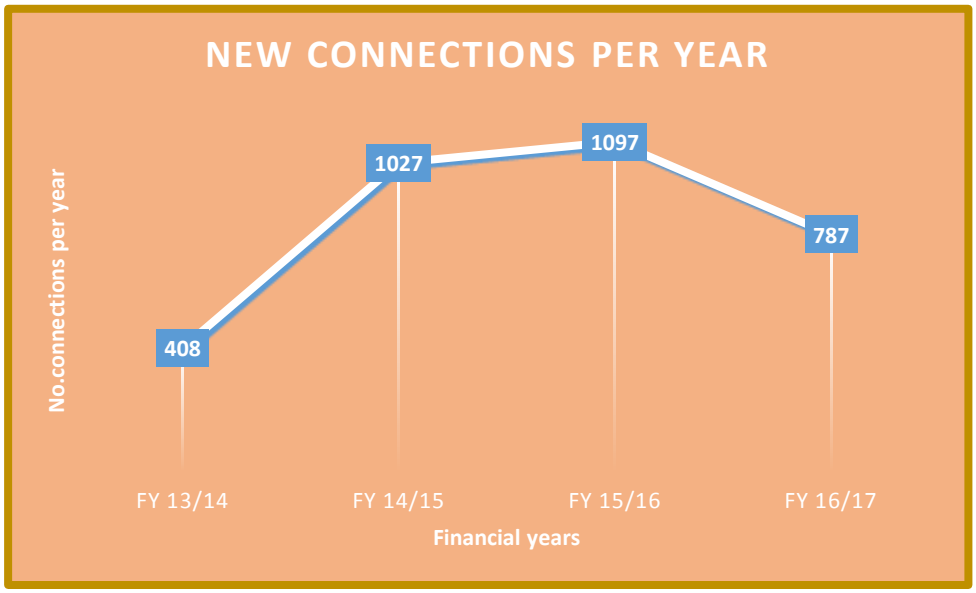

Figure 12: Analysis of new connections trends from Bushenyi Operational data Fy13/14 to 16/17.

In order to achieve NWSC rapid expansion service delivery model, Bushenyi/Ishaka area has extended services beyond the geographical boundaries of the municipality although this is outside its mandate of operating only in urban centres. It is being fuelled by the increased political and public demand for services. The map below shows the extent to which the pipe network has gone beyond NWSC mandated service area

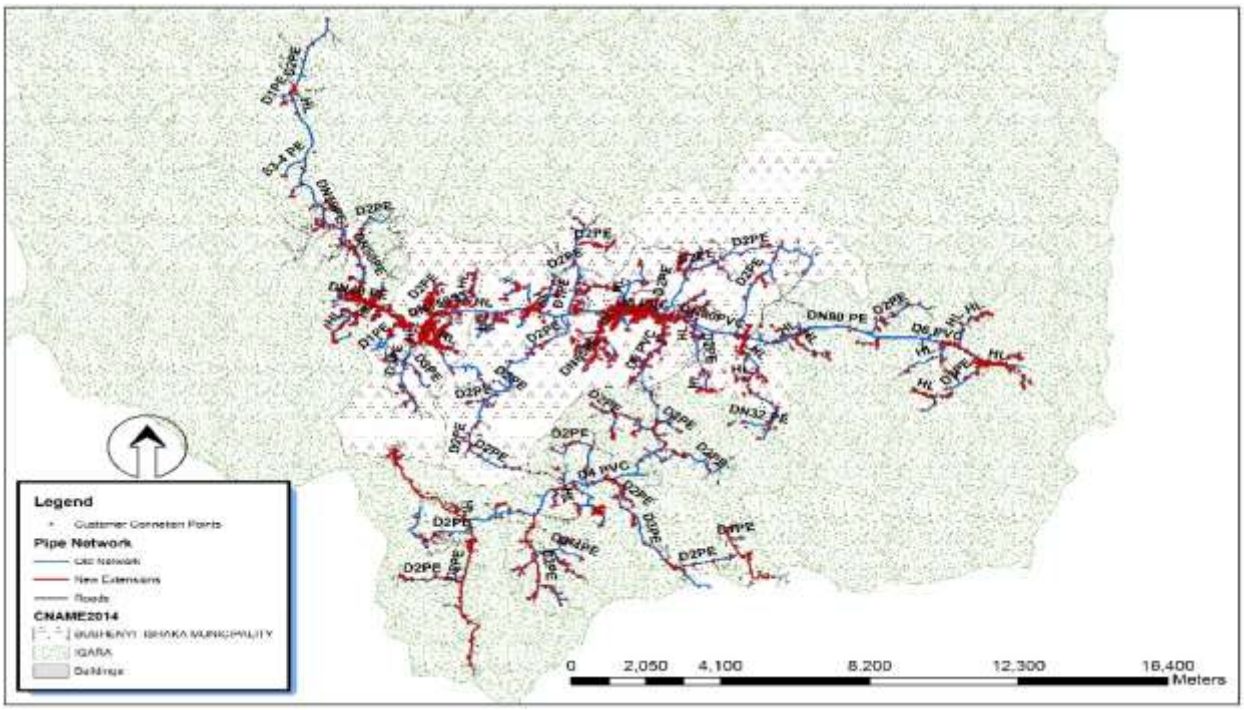

Figure 13: Updated 2017 GIS map of Pipe Network laid beyond Bushenyi/Ishaka Municipality

5.1.2. Demand driven designs of the distribution Pipe network

In here, the community in need initiate the demand for services through the local leadership. Specifically the chairman Local council 1 (LC1) mobilises the community to request for services by formally writing to NWSC Bushenyi main and the branch offices. A physical survey of the community to benefit from the mains extension is then undertaken to assess the viability of the place (cost-benefit analysis), distances, size of existing pipe, topography of land and elevations for pressure rating. This approach has to a large extent enabled the utility to precisely extend services to locations where there is actual demand for services. Although sometimes the local politicians also put pressure on NWSC to extend services to locations with less demand and resultantly only a few people connecting to the network [36]

When making choices of the sizes of pipes to be laid, more focus is given to sub-mains and intensifications as a mode of service extension. "Generally for the reason that, the mains extensions may not respond to demand but sub mains or intensifications are the ones that respond to demand since they criss-cross villages and costs of connections is reduced enabling many people to connect"[37]. A demand for services of less than 15 people is considered a new connection and an intensification is laid (pipe sizes 1", 1¼") but a demand for more than 15 people calls for sub and mains extension (2", 3" and above). Hence the use of small diameter pipes of sizes 1inch to 1¼inchs commonly referred to as "intensifications" though they are developed hand in hand with mains extensions (large diameter pipes of 2" and above) is considered as an effective means of extending services in Bushenyi. It is how decision making is reached. In other words, emphasis is put on not only extending services randomly but viable extensions that are high impacting in terms of wider coverage and quick returns to investments.

[36] BI1,BI2, BI4 Respondents 1,2&4 from NWSC Bushenyi/Ishaka Area
[37] BI2 Respondents 2 from NWSC Bushenyi/Ishaka Area

5.1.3. Nyarunzinga Plant production capacity mismatch with utilization.

The Nyarunzinga treatment plant built by Government of Uganda (GOU) was designed to produce water to adequately serve only the Bushenyi/Ishaka Municipality with a designed capacity of 2000m³/day. Despite of the recent upgrade of the plant to increase production capacity, results show that during the wet season, when the water table at the wetland is normal and at full production, the plant produces averagely 1500m³/day and during dry season's production drops as low as 500m³/day. It operates at 75% capacity utilization implying plant not fully utilized (still has capacity to produce additional 500m³/day). In fact, as put it by BI1"Nyaruzinga plant would have the capacity to sustain water service delivery and adequately meet demand projected to increase to 3000m³/day in the next 5years if it was not drying up during dry spells". The indication of this, is that the plant was over designed though not by NWSC, the reason for the overdesign is because of the use of standard national designs in the water supply design manual that project future demand of 10 to 20 years instead of actual demand which has not been realized (M.W.E-Manual, 2013). This has already been highlighted as a problem occurring in towns (N. Pilgrim et al., 2007).

5.1.4. Shortfalls in the utilization capacities of Bushenyi/Ishaka Cluster

When the cluster is combined the total production capacity of the plants is estimated at about 4,521m³/day with a capacity utilization of 73% as at the end of 30th June 2017 (NWSC-Annual.Report, 2017). It should be noted that each town has an independent water supply system with the exception of Bushenyi and Ishaka towns that have an interconnected pipe network with one water treatment plant at Nyaruzinga water works .Below is the analysis of the combined production capacities of the treatment plants of Bushenyi/Ishaka as a cluster to assess how the use of standard designs while developing treatment plants have impacted on actual capacity utilization (demand) from the financial years 2013 to 2017

Table 10: Aggregated Production Capacities of Bushenyi/Ishaka Cluster

Financial Years (FY)	*FY 13/14*	*FY 14/15*	*FY 15/16*	*FY 16/17*
Designed/practical Plant Capacity (m^3/day)	2,000	3,104	3,233	4,521
Average Production (m3/day)	1,476	1,952	3,244	3,317
Capacity Utilization (%)	74%	63%	100%	73%

Source: Authors analysis of 4years Bushenyi Area production data.

Similarly the outcome of over designing the plant capacities to meet future demand instead of current actual demand is observed in almost all the financial years except for FY15/16. The plant capacities were underutilized in FY 2014, 2015, and 2017 with capacity utilization of 74%, 63% and 73% respectively, literally this would mean the cost of water would be too high resulting from high investment costs. In the FY2016 the practical plant capacity was fully utilized at 100%, that is to say production was at optimal level, although it dropped again in FY2016/2017 attributed to rehabilitation of the Nyarunzinga plant to increase production and the takeover of more towns with new plants. The lowest capacity utilization was recorded in the FY 14/15 at 63%. See the graphical illustration below.

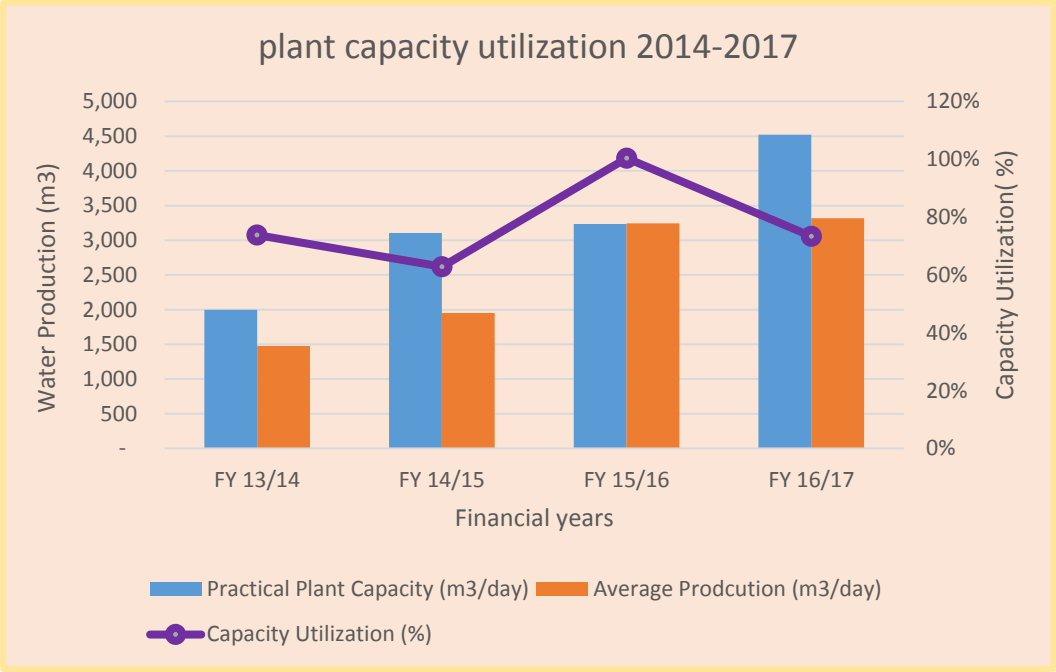

Figure 14: Analysis of plant capacity utilization trend.

In spite of Bushenyi cluster being unable to operate at full capacity, the annual water production has constantly been on the increase since NWSC channelled its focus to the development and revamping of the infrastructure in towns. A reflection of the relevance of developing infrastructure to meet the ever growing demand for services. From FY13/14 water production has increased from 538,670m³/yr. to 1,210,764m³ as per the end of Fy16/17 a growth rate of 125%. The trend is illustrated in the figure 15 below.

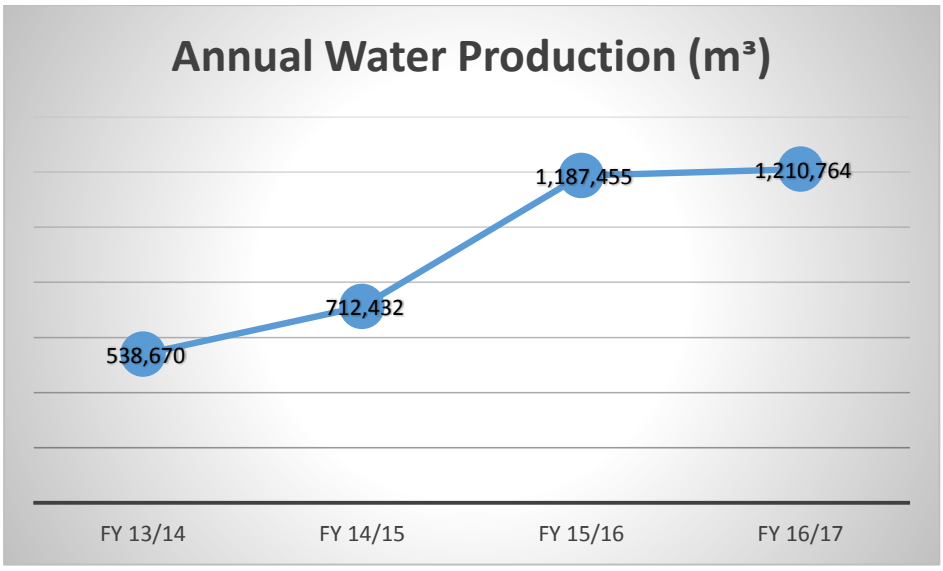

Figure 15: Performance trend of the annual water production (m³) for Bushenyi/Ishaka Cluster

5.2. Service stabilization aim

After takeover of a town and subsequent rapid development and rehabilitation of the infrastructure, the next agenda of NWSC was to guarantee that there is constant water supply in the towns through carrying out "quick fixes" of the defects in the water supply systems inherited and also continue expanding the pipe network to improve on the connectivity in towns. The ultimate goal is to enhance viability through more new connections to increase billing from a wider coverage/access and also to progressively improve on the number of hours of water supply, usually from a few hours common in towns to a reasonable number of 12hrs/day then ultimately a target of 24/7hr supply. More reliable services would increase on water sales and thus revenues that would cover O&M of the water system and also increases the visibility of the utility[38] .

5.2.1. Water supply stabilization challenges

Water supply and infrastructure growth in Bushenyi is heavily hinged on the reliability of its water sources which have posed a peculiar challenge to the area and has shaped how and why infrastructure is developed, the financial flows and service provision in the town as it was strongly emphasized[39]. The wetland/swamp where surface water is abstracted is mainly recharged by rainfall thus during dry season when there is no rainfall the wetland dries up and there is little or almost no water produced and supplied. Thus supply has continued to be intermittent but it is more prevalent in the dry spell whereby the area is forced to rationed services in order to meet the demand. In actual, supply during rainy season is put at 24/7hrs however, in the dry spell (July to September), water supply is for half a day (6hrs)[40] though even when there is sufficient production some hilly places don't receive water 24/7hrs because of the terrain of the land. However, the management of the utility has come up with proactive short term measures to sustain service delivery during dry season. Such as the initiatives of partnering with a private irrigation project- (Presidential Initiative on Banana Industrial Development (PIBID) to interconnect the irrigation transmission pipe line from another source of water with NWSC transmission line, then water is pumped to the treatment plant

But as a lasting solution to overcome this challenge NWSC is currently constructing a massive new treatment plant at Kitagata to augment supply. Which has a daily production capacity of 3000m^3/day, this is sought to solve the challenges of intermittent water supply and be able to meet the increasing demand for service within Bushenyi/Ishaka town and the satellite towns. However, "this project will turn out to be a white elephant if there is no catchment protection, the source of water for the new treatment plant will also dry up"[41]. Other options of borehole drilling are also being pursued, so far four boreholes have been drilled still to boost the water supply to ensure continuity, therefore with this interventions there is hope that Bushenyi will have a stable supply in the future[42]

[38] Hq1,Hq2, BI1 Respondents 1&2 from Head office and respondent 1 from Bushenyi/Ishaka Area
[39] All the respondents interviewed from Bushenyi/Ishaka
[40] BI1-BI7 Respondents 1-7 from NWSC Bushenyi/Ishaka Area
[41] BI1 Respondents 1 from NWSC Bushenyi/Ishaka Area
[42] BI2 Respondents 2 from NWSC Bushenyi/Ishaka Area

5.2.2. Monitoring service levels

To be certain on service levels in NWSC towns, regular monitoring is conducted annually by the NWSC Head office through the call centre staff. Frequently customers are randomly called to find out on their supply challenges and also through the annual customer satisfaction surveys (CSS). Customers of respective towns are requested to give feedback by rating the performance of NWSC towns in terms of unreliable and intermittent water supply. Unsurprisingly, the CSS of 2017 ranked Bushenyi/Ishaka the 3rd out of over 200 NWSC towns with the highest number of complaints and criticism for unreliability of services. However the general customer satisfaction index shows a high performance above NWSC minimum standard of 80%. An indication that customers appreciate the efforts and interventions that the utility is putting in place to guarantee supply reliability, thus high willingness to pay for services. The performance trend in the CSI for the period under review for Bushenyi is highlighted below

Table 11: Bushenyi Area CSI performance from FY2013/2014 to 2016/2017

	FY 13/14	*FY 14/15*	*FY 15/16*	*FY 16/17*
Customer Satisfaction Index (%)	96%	97%	92%	86%
NWSC Min Standard (%)	80%	80%	80%	80%
NWSC target (%)	100%	100%	100%	100%

Source: Author's Analysis of NWSC annual Customer Satisfaction Survey Reports from FY13/14-16/17

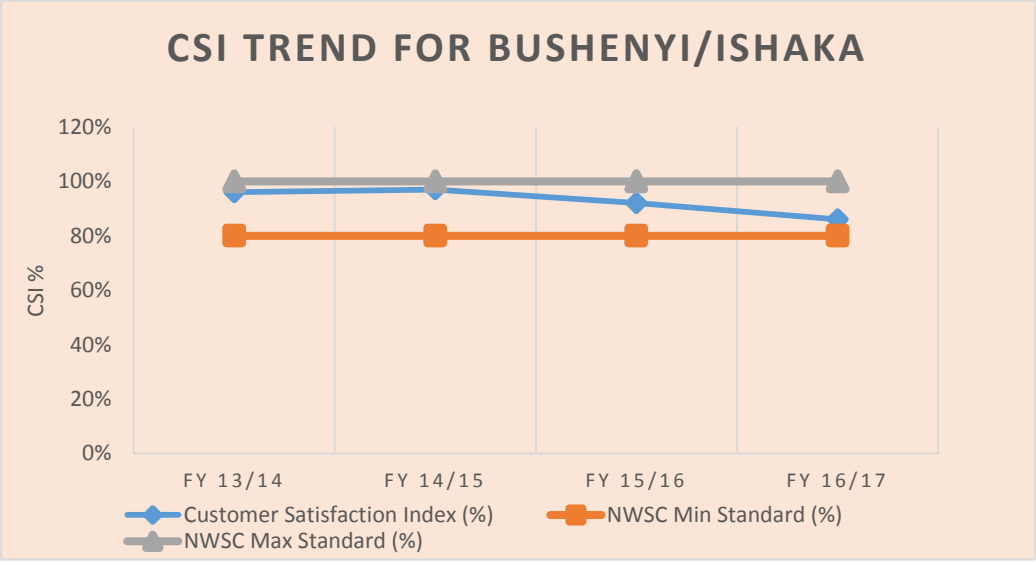

Figure 16: Customer Satisfaction Index (CSI) Trend for Bushenyi/Ishaka

5.3. Strive for Financial sustainability in Bushenyi/Ishaka

Following the rapid infrastructure growth together with takeover of new towns to expand services and major interventions to stabilize supply. Presently the NWSC's focus is veering towards getting the town utilities to the right path of being financially sustainable in order to reap from the earlier on massive investment in infrastructure. The aim is to improve the viability of towns through increasing billing to enhance the working ratios, improving unit costs of production below the tariffs by Optimizing operational expenditures and cost effectiveness on Capital expenditure through proactive approaches that reduce cost on investments.

5.3.1. Low cost schemes to Investments

Cost sharing initiative- as one way of sharing the costs of investments the customers from the benefiting community are requested to provide free physical labour for excavating trenches with NWSC bearing the costs of pipes and fittings (Mugisha & Berg, 2017). This is where by the community mobilise themselves and provide free labour for excavation of the pipe network and NWSC extends services. Bushenyi area has taken an extraordinary lead in implementing this approach where the community trench for themselves at a free cost" this has been achieved through proactive sensitization and community engagement. "This approach has greatly reduced on the cost of service expansion by over 50% as explained"[43]. Take an example, given the NWSC standard rates provided to the engineers for estimating the costs of developing mains extensions for budgeting purposes where by a 2" HDPE pipe costs Ushs 8,000/meter, labour costs at Ushs 2,500/meter and cost of fittings is 10% of total cost of labour and pipes. The savings made from labour costs from 3 randomly selected mains extensions established using the cost sharing initiative are illustrated below.

Table 12: Typical NWSC Cost Estimates of 2"Pipe HDPE PN10

Costs of mains extension (2"Pipe HDPE PN10)						
Location	**Pipe length (m)**	**Cost of pipe (Ushs 8,000/m)**	**Fixed Labour cost (2,500/m)**	**Fittings cost (10% total cost)**	**Total Cost (Ushs)**	**% savings Labour**
Opposite Court Road	2,000	16,000,000	5,000,000	2,100,000	23,100,000	22%
Kabagarame-Ruharo l	4,000	32,000,000	10,000,000	4,200,000	46,200,000	22%
Rwakanyonyi	3,000	24,000,000	7,500,000	3,150,000	34,650,000	22%
Total	**9,000**	**72,000,000**	**22,500,000**	**9,450,000**	**103,950,000**	**22%**

Source: Analysis of mains extensions cost estimates (Capex budget 2015/2016)

From these three mains extensions alone the utility was able to save Ushs 22.5 million which is 22% of total cost of the mains extensions resulting from the cost sharing initiative with the community. The money saved is re-invested in purchasing of more pipes. This has also translated into rapid increase in the number of kilometres of pipe network extension laid by the utility.

5.3.2. Strategy of reducing Capex on Pipe Network

In the last four years (2013 to 2017) Bushenyi cluster has seen its Capital expenditure on mains extensions alone over blown beyond the annual budgets for it to be in position to meet the ever increasing demand for services in towns. Capex on pipe network tremendously shot up above annual budgets particularly in FY13/14 to 14/15 during NWSC infrastructure growth evolution period. However, Capex on pipe network started to be gradually reduced from FY15/16 to 16/17, an indication that the utility is moving away from pumping more funds into pipe network development to focus more into returns to investments already made to steer towards being financially sustainable. In the table below, shows the Capital expenditure budget on pipe network and the billing trends for Bushenyi for four financial years (FY13/14 to 16/17)

[43] BI1 Respondents 1 from NWSC Bushenyi/Ishaka Area

Table 13: Bushenyi Area Capex on pipe Network for the period 2013 to 2017

Financial year	FY 13/14	FY 14/15	FY 15/16	FY 16/17	Averages	% growth
Budget Mains extensions Costs (Ushs) million	44,377	129,445	317,500	185,640	169,241	281%
Actual implemented Costs (Ushs) million	658,460	1,829,764	1,179,709	689,497	1,089,358	65%
Billings Ushs 'millions'	1,097,276	1,257,464	2,789,407	2,644,450	1,947,149	77%

Source: Author's analysis of the Bushenyi Area approved Capex budget on mains extensions

In general there has been a huge sum of funds sunk into mains extensions from NWSC head office, it is argued that because of the explosive growth of the population of Bushenyi/Ishaka municipality and the annexation of satellite towns is responsible for the increased demand for services. As a response NWSC had to commit more funds beyond its annual Capex budgets for expansion of services to match the demand, to the extent that annual average actual expenditure on mains extensions alone has increased by 65% since FY2013/14. In return the annual average billing has also progressively increased though not proportionally from Ushs one billion in FY 13/14 to an annual average of Ushs.1.9 billion by 2017 a growth of 77%. An indication that there is potential in towns to grow given the right investments and strategies of infra development. Therefore utilities in towns should be prepared with investments to match up the demand in order to realise business growth and expand services.

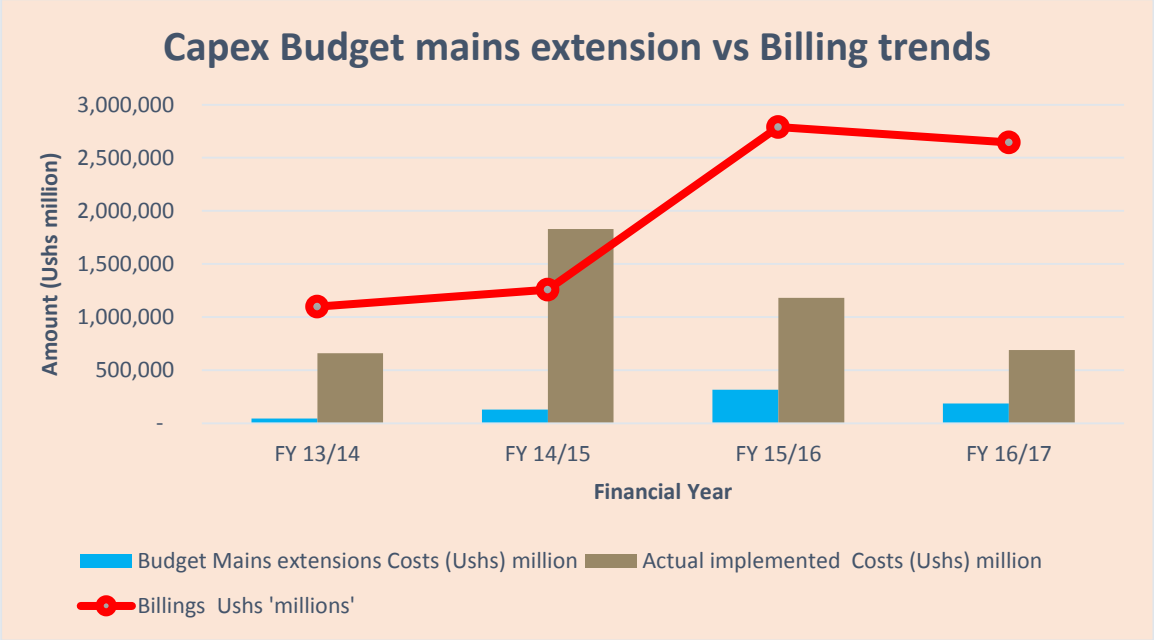

Figure 17: NWSC Bushenyi Analysis of expenditure on mains extensions vs Billings

It should be noted that the funding of the Capex budget on distribution pipe network is entirely through the NWSC head office conveyed through Performance Autonomy and creativity Enhancement (PACE) contracts that the Bushenyi area has signed with NWSC head office. Some mega projects such treatment plants are funded by donors for example the multibillion Kitagata water treatment plant under construction in Bushenyi is being funded by both World

Bank though the GOU and NWSC internally generated funds. Whereby 75% of the project budget is GOU that on-grants to NWSC and 25% is from NWSC coffers. Therefore the utilities in towns are not allowed to get investment loans.

5.3.3. Struggles to the pathway of viability Bushenyi/Ishaka

Going by NWSC Head office measurement of financial sustainability using the financial indicator of working ratio, Bushenyi/Ishaka cluster is still not yet a viable utility given that by the end of the financial year 2017 the WR was at 107%. On the other hand using the Bushenyi/Ishaka area measurement of financial sustainability based on the financial indicator of "Cash Operating Margin" (COM), which is defined as the difference between incomes/revenues and operating expenditure, the utility posted a positive COM of Ushs 16 million in the FY16/17. Implying that the area was able to meet its operational costs and remain with a surplus though small but can be re-invested for minor investments because the revenues collected are higher than the operating expenses. However, the biggest cost of the utility is employee related costs, static plant and pipe network maintenance accounting for 48% and 23% respectively of the total operating expenses in the FY2016/2017.

Table 14: Bushenyi/Ishaka Incomes and Expenditures from FY2013/2014 to 2016/2017

	FY 13/14	FY 14/15	FY 15/16	FY 16/17
TOTAL INCOMES Ushs '000'	**1,068,354**	**1,508,939**	**2,542,593**	**2,833,343**
OPERATING EXPENSES				
Employee related costs	579,234	932,792	1,315,712	1,359,860
Premises and maintenance	26,510	57,360	75,794	103,769
Static Plant & Pipe Network Mtnce	366,528	530,929	727,019	650,850
Transport & Mobile Plant	30,687	80,052	93,458	103,300
Supplies & Services	126,618	219,872	319,686	316,895
Administrative Expenses	102,837	215,499	222,894	282,691
TOTAL OPERATING EXPENSES Ushs '000'	**1,232,414**	**2,036,504**	**2,754,563**	**2,817,365**
Billing Ushs '000'	1,097,276	1,257,464	2,789,408	2,644,450
Cash Operating Margin Ushs '000'	-164,060	-527,565	-211,970	15,978
Break Even Analysis/WR (%)	112%	162%	99%	107%

Source: Authors analysis of audited Income and Expenditures statements of accounts for Bushenyi /Ishaka Area

Breakeven (viability) analysis trends from the time of launch of the infrastructural revolution shows that Bushenyi area has gradually improved its working ratio from 112% in 2013 to 107% in 2017, indication that the utility is heading towards the right direction of being financially sustainable as demonstrated below

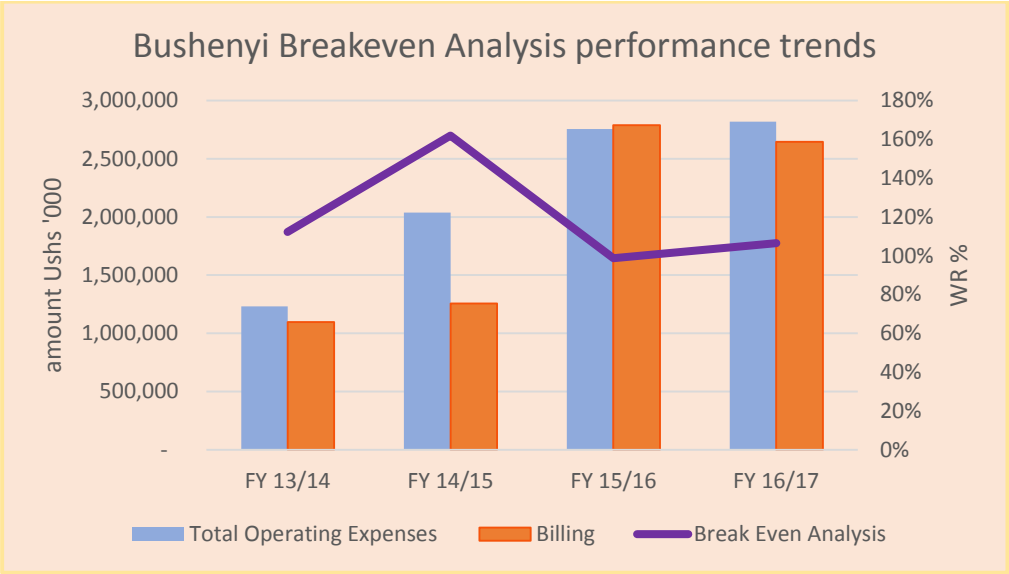

Figure 18: Performance trends billing, Opex and Working ratios

Although Bushenyi area has an average working ratio of 120% and is not breaking even, but all respondent agree that with the upcoming commissioning of the Kitagata treatment plant slated for January 2018, the area is projected to grow billing to an estimate of Ushs 400 million/month, services will expand by July 2018 and consequently break even and start supporting other towns that are not breaking even[44]. In addition, water sales being the main source of revenue for the area, many programmes have been initiated to enhance billing and revenue collection performance of the area for example Performance Enhancement with Safe Sanitation (PEWISS) programme that is coordinated by the commercial section has seen the utility increase its monthly billing progressively from Ushs 1 billion at the end of 2014 to Ushs 2.6 billion in 2017 and an annual increment of Ushs 6 billion in five years' time is projected[45]. Therefore "Bushenyi/Ishaka area has been able to demonstrate that small towns can turn out to be viable with the right investment plan in place that drastically stabilizes and expands services and a well-structured financial management system with some external support.

5.3.4. Analysis of tariff vs unit cost of production

As earlier mentioned in chapter 4 that NWSC HO applies a uniform tariff to all its operational areas for purposes of equitable provision of water supply services across the country. Therefore utilities in towns are not mandated to levy independent tariff bands for water and sanitation services regardless of the costs of operations incurred. The tariff is structured in such a way that, it is able to recoup at least O&M costs plus depreciation and remain with some surplus for investments, thus the operational areas are tasked to meet the O&M costs as a minimum requirement through their water sales revenue[46]. However, due to low economies of scales and densities and operational inefficiencies that are prevalent in towns, small towns have higher unit cost of production of water than large and medium towns (World.Bank, 2017). Below I

[44] BI1 to BI7 Respondents 1 to 7 from Bushenyi/Ishaka area
[45] BI1, BI3, BI5 Respondents 1, 3&5 from Bushenyi/Ishaka area
[46] Hq1,Hq4, BI1, BI3, Respondent 1&4 from head office and Respondent 1&3 from Bushenyi/Ishaka

present to you the analysis on performance of the NWSC weighted average tariff against the unit cost of production of water in Bushenyi/Ishaka for the period 2013 to 2017.

Table 15: NWSC Bushenyi/Ishaka Tariff vs unit cost of Production Analysis

	FY 13/14	*FY 14/15*	*FY 15/16*	*FY 16/17*
Unit Cost per m3 (Ushs)	3,371	3,939	3,236	2,770
Weighted Average water Tariff	2,422	2,263	2,668	2,855

Source: Author's analysis of the audited NWSC annual reports 2013 to 2017

This means for that period the tariff alone was unable to recoup the O&M costs plus depreciation, therefore the operations of Bushenyi were being subsidized by other medium and large towns that were making surplus from their operations. However, there is a sigh of hope as the unit cost of production declined below the weighted average tariff in the FY2016/2017 implying from tariffs alone, the utility was able to meet its O&M costs and depreciation, an indication of being on the ideal pathway of financial sustainability. A graphical presentation below shades more light

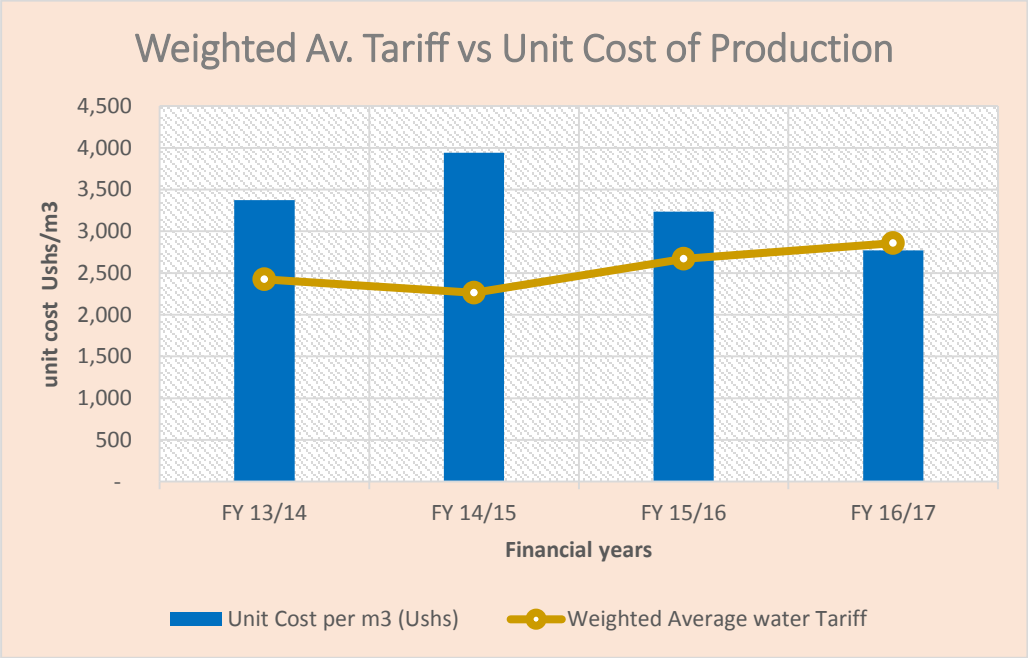

Figure 19: Performance trend of weighted av. tariff against the unit cost of production for Bushenyi town

5.4. Rapid Infra growth of NWSC Kitgum Operational Area

The water supply system for the town of Kitgum was one of the first five systems that were taken over by NWSC in 2013 following the organization's change of direction of focus in service delivery from the orientation of profit maximising to a larger focus on expansion of services. Therefore it was one of the pioneering towns for the change of strategy for service delivery. Kitgum town was estimated to have a population of about 44,604 people according to the National population census of 2014 (UBOS, 2014). Current customer base is 2,979 with a monthly average billing of Ushs 73 million and revenue collection of Ushs 66 million giving a

collection efficiency of 91% as at 30th June 2017 (Kitgum.Area, 2017; NWSC-Regional.office, 2017)[47].

When NWSC took over the management and operations of Kitgum water supply system, the total distribution pipe network was only 62km but since then with the increase in demand for services, the area has expanded its distribution network to the total length of 94km that shows a growth of infra by 52% within a period of four years. .Annual trend of mains extensions for Kitgum town show that although the utility doubled the number of kilometers above the minimum target of 5km set by NWSC for new towns taken over in the first two years of operations but the annual trend of mains extension laid has persistently been dropping. Something the management of Kitgum explained that, sometimes NWSC HO delays to deliver pipes or they are given pipes less than the approved capex budget for mains extension due to financial constraints and bureaucratic processes. In particular, FY 15/16 and 16/17, they had budgeted for 9km of pipe network for each year but they only received 6km and 3km respectively which were laid (NWSC-Ops.Capex, 2017, 2016)[48]

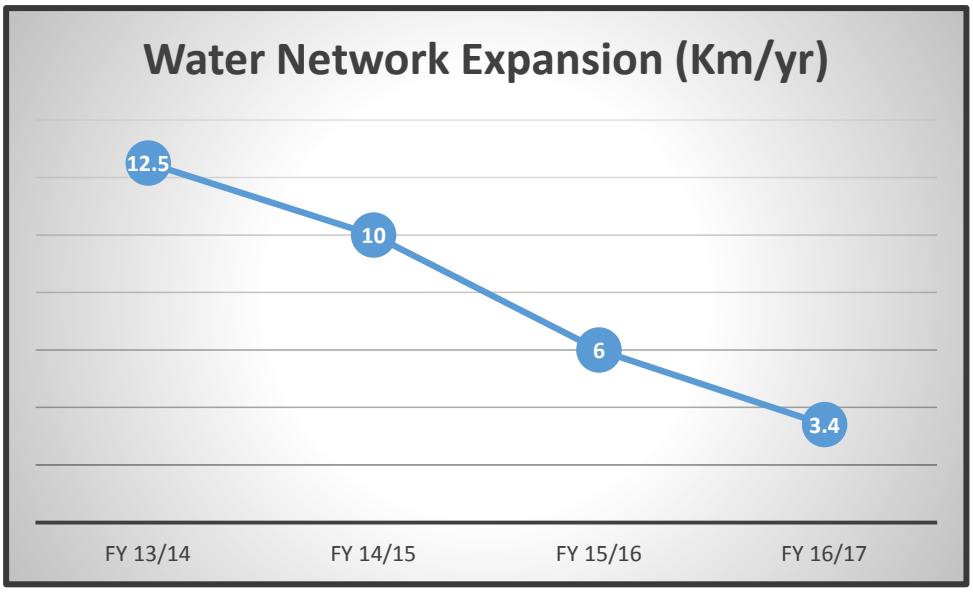

Figure 20: Analysis of Capex budget on mains extensions Kitgum Source: NWSC Capex Budget Reports

5.4.1. Impact of the reforms on Access/coverage of services

The Service coverage in Kitgum area has greatly improved from the estimated 65% in 2013 to current estimate of 80% within the Municipality boundaries as stated by[49]. NWSC Kitgum is also extending service beyond the municipal boundaries to the peri-urban settlements that are rural thru household connection but largely water points. The clients they serve according to NWSC categorization include; domestic (household consumers), commercial (business community), institutions (schools and hospital) and ministries (Police, prisons and army barracks). There is a general ambition to achieve a target of 100% service coverage by 2020

[47] KA1, KA2, KA4 Respondents 1,2&4 from Kitgum Area
[48] KA1, KA2 Respondents 1&2 from Kitgum Area
[49] KA2 Respondent 2 from Kitgum Area

through the implementation of the ongoing SCAP100 programme. Here presented is a pipe Network map of service coverage beyond the Kitgum municipal boundaries

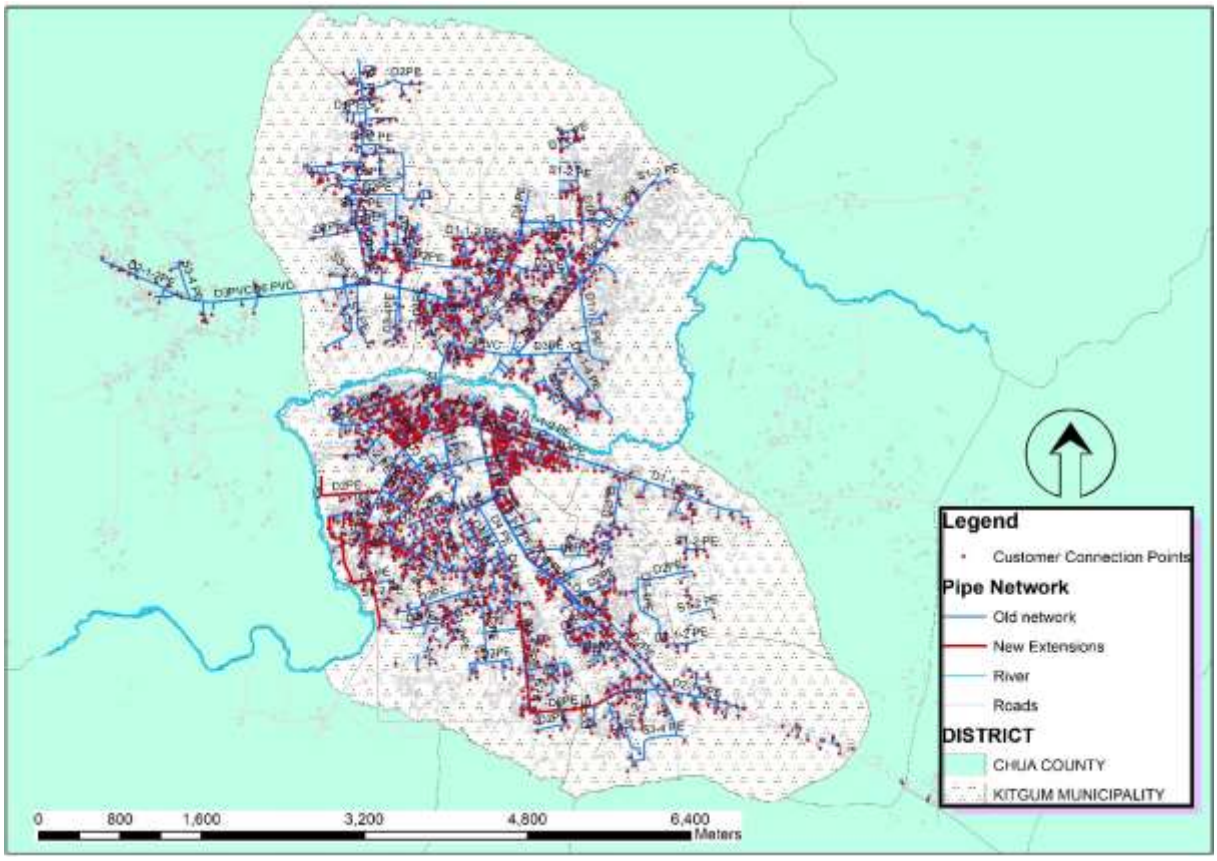

Figure 21: Pipe Network for NWSC Kitgum Service Area

Expansion of the pipe network has resulted into increased number of connections from the inception of network expansion service delivery model. Connections increased from 1,968 in FY2013/2014 to 2,976 in the FY2016/2017 reflecting a 51% growth rate. However, the average no. of new connection established per year has declined by 28% resulting from the decline of 48% of average number of pipe network expansion laid. This is graphically illustrated from the figure 22

Table 16: Kitgum Area performance on Network expansion and New connections made

	FY 13/14	*FY 14/15*	*FY 15/16*	*FY 16/17*	*Average*	*Growth/Decline*
Water Network Expansion (Km/yr.)	12.5	10	6	3.4	6	-48%
New Connections Per year	529	574	233	329	379	-28%
Total Connections	1968	2497	2730	2979	2544	51%

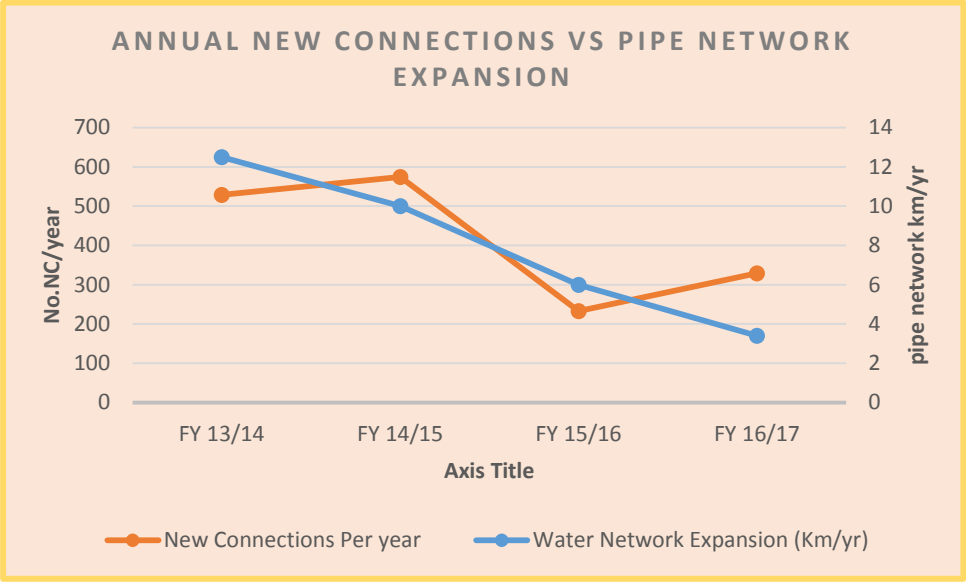

Figure 22: performance trend of annual new connections and pipe network expansion from 2013 to 2017

It is also claimed that infra development in Kitgum has brought employment, increased service expansion has created job opportunities within the utility, two plumbers and one plant operator have been added to the technical staff of Kitgum. Water vending is now a booming business in the municipality, water vendors draw water from the water kiosks installed and selling it to customers where the extensions have not yet reached. Therefore the customers and Kitgum municipality have benefited more from the infra development, the considerable reliability in services has improved livelihood of the community in terms of safe drinking water and some income from sale of water, brought development in the area and its believed it contributed to the elevation of Kitgum Town council to Municipality status

5.4.2. Growth projection design of the distribution network

Critical decisions on which locations to expand the network is based on demand surveys conducted by the field team regularly, they look out for potential areas that are developing in terms of building constructions, markets, schools, congested villages, trading centres and sometimes they get written requests from local authorities or leaders to extend services to their villages, population densities are taken into consideration in order to reach a decision. In a nutshell, mains extensions are based on growth projections whereby a main line is laid with expectation of meeting future demand resulting from anticipated growth of the area.

Data often used for design of the pipe network is the sizes of the existing pipe lines which is got from the GIS updated maps of the area, current population consumption patterns per local councils. Much emphasis is put into consideration of the capacity of the existing pipe line in place to accommodate further extensions, as stressed "we cannot extend water say for about 5km, when even the existing pipeline does not allow for further modification to extend service to about 1km"[50]. This design approach of the distribution network suggests more emphasise on the technical aspect of the designs. But, planners when designing town water systems are urged to integrate both technical and financial viabilities of the infrastructure because any mistake can

[50] KA2 Respondent 2 from Kitgum Area

lead to great financial impact to utility, high initial investment costs which is transferred to customers inform of increased tariffs (Pilgrim et al., 2004).

5.4.3. Overdesign of production sites

NWSC Kitgum area inherited a water supply system that has two sumps (production sites) named Primary Teachers College (PTC) sump and Hilltop sump. They abstract underground raw water using 5no.motorized boreholes that pump water to the sumps where the water is treated from, using only chlorine. Three boreholes (Mican, YY Okot and KTI) pump water to PTC sump and 2 boreholes (Pandwong and Lemo) pump water to hilltop sump. Water from the sumps is pumped to two elevated tanks with storage capacities of 300m^3 each. It's from these elevated tanks that water is distributed by gravity to the town centre and surroundings using a range of interconnected pipe network. In other words, Kitgum operational area is being served by two separate centralized water supply system.

Analysis of the production capacities for the combined treatment plants for the last four years (2013-2017) shows that the plants where over designed to provide for excess capacity that meets future demand which has not yet been realised. The average water production per day against the practical plant capacity for the period under review shows that there has been gross underutilization of plant capacity because capacity utilization is even below 50% of practical plant capacity since NWSC takeover of the water supply system as shown from the table below.

Table 17: Plant Capacity utilization and practical plant capacity for FY13/14 to 16/17

	FY 13/14	FY 14/15	FY 15/16	FY 16/17
Practical Plant Capacity (m3/day)	2539	2539	2376	2376
Average Production (m3/day)	472	866	921	841
Capacity Utilization (%)	19%	34%	39%	35%

Source: Authors analysis of Kitgum Area water production data

Luckily for NWSC Kitgum, they do not have to recover the investment costs for the treatment plants because the plants was built by the GOU, otherwise the water supply system would be too expensive to operate and maintain as the price of water would inevitably be too high. Graphical performance trend of plant capacity utilization of NWSC Kitgum system is hereby illustrated.

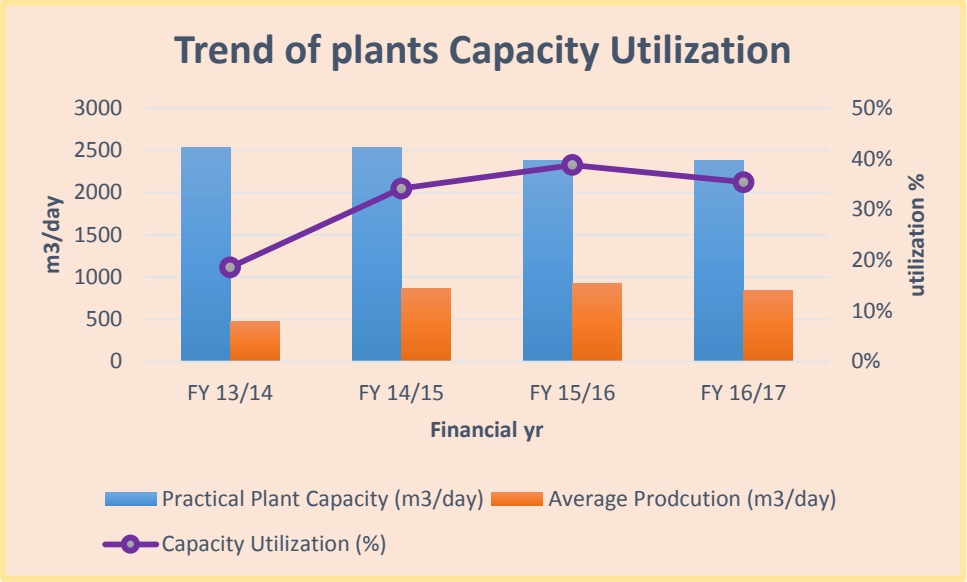

Figure 23: NWSC Kitgum four year Plant Capacity Utilization

Regardless of the underutilization of plant capacity, water production in Kitgum has seen substantial improvement since the launch of rapid expansion of services. The utility improved its annual volume of water produced from 172,172m³/annum in 2013 to an average of 283,162m³/annum, a percentage growth of 64%, this is an indication that due to the increase in demand for services, and reliability has also improved despite of the intermittent supply during the dry seasons. Performance trends is illustrated below

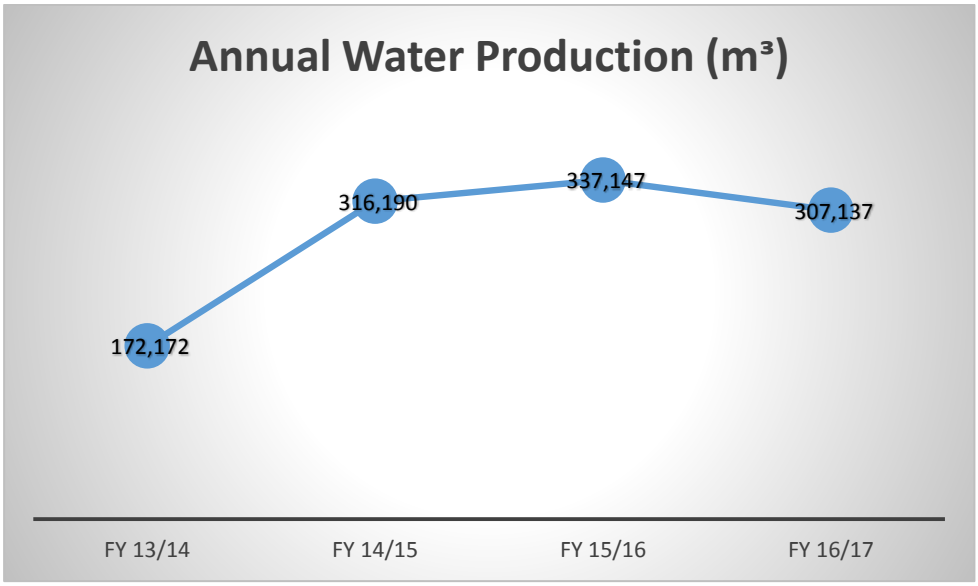

Figure 24: Analysis of the production data for Period (FY13/14-16/17)

5.5. Challenges of water supply stabilization in Kitgum

When NWSC took over Kitgum town council water supply system in 2013, the service levels were predominantly low, water production was low despite of having plants with big production capacities but producing only on average 14,348m³/month, the distribution network was only 62km covering about 65% of the municipal population and service reliability was as low as 2 to 3hrs water supply a day[51] a situation that is synonymous with water supply services in small towns often referred to as "low level Equilibrium"(World.Bank, 2017). Some interventions that are being undertaken to address the challenge include; drilling of 2 additional high yield boreholes to augment the existing ones as quick fixes to guarantee supply; procurement of pumps and securing a generators for standby power since one of the biggest challenges faced by the utility is erratic power supply from the Electricity Company. Sometimes, there is sufficient water to supply but power is on and off affecting production, hence unreliability of services[52]

Supply reliability keeps fluctuating resulting from season variations and the particular locations of customers because the Area is reliant on ground water sources therefore averagely, the supply is 16 hrs per day. During rainy season the service level is high (service is everywhere) but during the dry season depends on ones' location, those near the main network grid will continue benefiting full time supply but those who are very far will have intermittent supply[53], though the area aims to achieve 24/7hr supply as per the NWSC standard. There are signs that the number of hours with supply is continuously improving from 3 to 6 to 12 and now to 16hrs, in fact for the period I was in Kitgum for data collection, I didn't observe supply interruptions.

Customer feedback is positive on service reliability, customers are generally satisfied with the level of service delivery. According to the Customer satisfaction surveys conducted from takeover of the system the average Customer Satisfaction Index has been 85% which is above the minimum of 80% as the acceptable level of service delivery by NWSC standards.

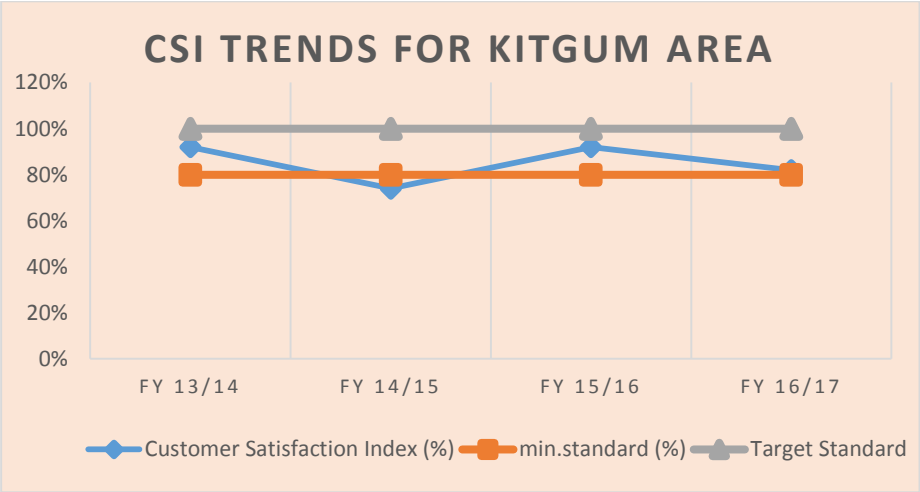

Figure 25: Analysis of the NWSC annual Customer Satisfaction survey Report (FY13/14-16/17)

[51] KA1, KA2, KA3, KA4, Respondents 1,2,3&4 from Kitgum Area
[52] KA2, KA3 Respondents 2 &3 from Kitgum Area
[53] KA2, KA4, KA5 Respondents 2,4&5 from Kitgum Area

5.6. Financial Sustainability Goal Kitgum

With the improvement of service levels, NWSC ultimate goal is to ensure that the operations in the town is efficiently managed to foster the utility to be self-reliant and guarantee sustainable delivery of services. In order to strengthen the urge for self-sufficiency, Capital expenditures for Kitgum Area have majorly been funded from NWSC Head office through, cross subsidies from other NWSC areas (Kampala water, Mbarara, Jinja and Entebbe) and also by the GOU investment subsidy for towns, as Kitgum town doesn't generate adequate revenue from the water sales as its major source of income to carry out capital investments and O&M. However, NWSC point of interest is to see to it that Kitgum Area is on the right track of being financially sustainable whereby as a minimum requirement, the local billings should be able to cover the O&M expenses plus depreciation in the long run as it was stated[54]

5.6.1. Frugal expenditure on pipe Network

NWSC invested heavily on mains extension to a tune of Ushs 104,055 million on the first year of operations (2013/2014) as it has been the practice to pump investment funds for newly taken over towns and then systematically reduced its pipe network expenditures to only Ushs 36,877 million, a decline of 65% by the end of FY 16/17. The gradual reduction of expenditure on pipe network indicates change of priority from minimum investments on pipe network to more focus on returns to investments by connecting more customers to the pipe network already established to increase billing. In return it has seen a steady growth in the billing by 183% by the end of FY2016/2017, a situation that is pointing towards being self-reliant.

Table 18: Budgets on Capex on Pipe Network and Billings for four financial years

	FY 13/14	*FY 14/15*	*FY 15/16*	*FY 16/17*	*Growth/decline*
Budget pipe network Ushs '000	-	54,900	114,000	98,280	79%
Actual Capex pipe network Ushs '000	104,055	90,792	86,571	36,877	-65%
Billings 'Ushs '000	307,651	544,517	764,595	870,787	183%

Source: Authors Analysis of the Kitgum Area annual Capex Budget for FY 13/14 to 16/17

Graphical presentation of the performance trends of Kitgum Area Capex budgets on the growth of billing is shown below

[54] KA1, KA3 Respondents 1 & 3 from Kitgum Area

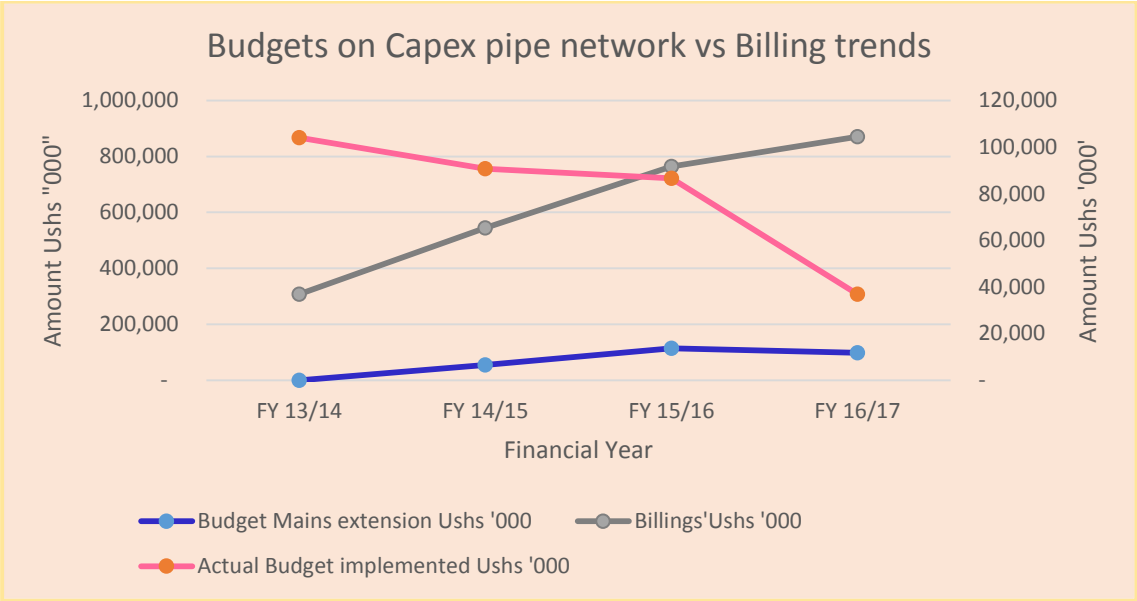

Figure 26: Four year Performance trends of Capex budgets on mains extensions and the billing

5.6.2. The struggles of being viable in Kitgum Area

The utility is tasked by NWSC Head office to meet O&M costs as a minimum requirement through local water sales revenue, from the monthly operational budget, however. Kitgum area is still struggling to meet all its O&M cost, still depends on other towns that have surplus income to finance its operations. It means the utility doesn't generate sufficient funds that can enable it cover its O&M costs including depreciation and remain with a surplus for investments. By the end of the FY 2016/2017, the average monthly billing was Ushs 72 million and the revenue collection was Ushs 66 million giving a collection efficiency of 91% (NWSC-Regional.office, 2017). This its self is a challenge, because the utility was not in position to collect all its billings hence inadequate cash flows.

On the other hand the average operating expenditures for Kitgum for the last four years (2013-2017) Ushs 892,741 million has been above the average billing of Ushs 621,888 million giving a working ratio of 144% a confirmation that the utility has not been breaking even (unviable). It's not generating sufficient funds to even cover its own O&M costs, later on some surplus for minor investments. The highest operational expenditure for the period under review has been on employee related costs and pipe network maintenance which accounted for 52% and 24% respectively for total operating expenses for the town.

Table 19: Income and Expenditures for Kitgum Area for Period FY2013/2014 to 2016/2017

Descriptions	*FY 13/14*	*FY 14/15*	*FY 15/16*	*FY 16/17*
TOTAL INCOMES Ushs '000'	**271,893**	**488,954**	**688,488**	**790,400**
OPERATING EXPENSES Ushs '000'				
Employee related costs	421,976	492,435	474,878	482,802
Premises and maintenance	32,937	19,093	21,223	29,097
Static Plant & Pipe Network Mtnce	155,829	188,713	230,525	277,898
Transport & Mobile Plant	28,101	49,116	45,746	52,348

Supplies & Services	25,027	17,749	16,710	35,442
Administrative Expenses	99,936	118,256	125,479	129,648
Total Operating Exp.	**763,806**	**885,362**	**914,561**	**1,007,235**
Billing Ushs '000'	307,651	544,517	764,595	870,787
COM Ushs '000'	(491,913)	(396,408)	(226,073)	(216,835)
Break Even Analysis/WR (%)	248%	163%	120%	116%

Source: Author's review of audited financial statements of Kitgum Area

However, from the time of takeover of Kitgum town, the working ration was extremely high due to high operational expenditures coupled with very low billing, but with the investments made by NWSC as an intervention to improve service delivery, the WR and the Cash Operating Margin (COM) have been improving from 248% and Ushs -491,913 million in 2013/2014 to 116% and -216,835 respectively, thus performance trend shows a positive down ward sloping curve. This therefore indicates that the utility though not yet viable but is on the right track towards being viable. A pathway that NWSC HO desires for towns water supply services to undertake.

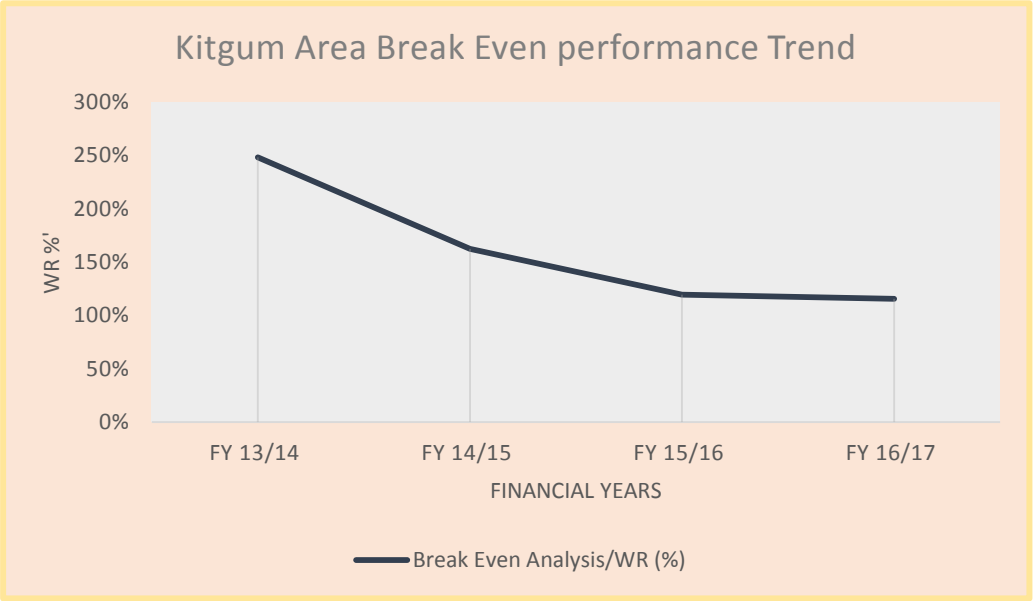

Figure 27: 2013-2017 Break Even Analysis for Kitgum

Besides the mains extensions, other in-house performance enhancement programmes have been initiated at the area level as efforts for striving for Financial Sustainability, an example of such programme is the SPARK120m an acronym for S-suppressed account[55] reduction, P-production growth. A-arrears reduction initiatives, R-revenue collection efficiency, K-know your customer. The aim of the programme is to improve all the above indicators to achieve a billing growth target of Ushs 120 million by the end of the financial year 2017/2018 (Kitgum.Area, 2017)[56]. It is the Kitgum area action plan with clear objectives and deliverables on how to make the utility viable. "Once the billing set target of 120 million is achieved, then the Area will be

[55] Suppressed accounts are water connections that are off supply, mostly disconnected for non-payment of bills
[56] KA1 Respondent 1 from Kitgum Area

financially sustainable"[57].it is claimed that there is more demand for services than supply, therefore to meet that demand, the area has to innovate and come up with action plan such as, drilling more boreholes to increase production and supply before end of FY 2017/2018[58]

5.6.3. Tariff and unit cost of production analysis for Kitgum Area

For the period under review (2013-2017). The cost of producing a cubic unit of water has generally been higher than the NWSC weighted average tariff. An indication that the NWSC uniform tariff alone does not recoup the operations and maintenance costs, depreciation and remain with some surplus for minor investments, the utility is not mandated to increase tariffs to recover costs. Therefore, Kitgum area has been relying on other large towns to sustain its operations through cross subsidies.

Table 20: Tariff performance and unit costs of production analysis for Kitgum

	FY 13/14	*FY 14/15*	*FY 15/16*	*FY 16/17*
Unit Cost per m3 (Ushs)	5429	3678	3530	3722
Weighted Average water Tariff	2422	2263	2668	3253

Source: Authors Analysis of audited NWSC annual reports from 2013 to 2017

However, due to persistent emphasis for the utility to optimize operational costs as an avenue of heading towards self-sufficiency, the trend is showing an improvement in the unit cost of production. Performance has drastically improved from Ushs 5429/m^3 in 2013 to Ushs 3722/m^3 in 2017 an improvement of 46% the gap between the unit costs and average tariff is narrowing a positive sign for the utility being on the path of financial sustainability

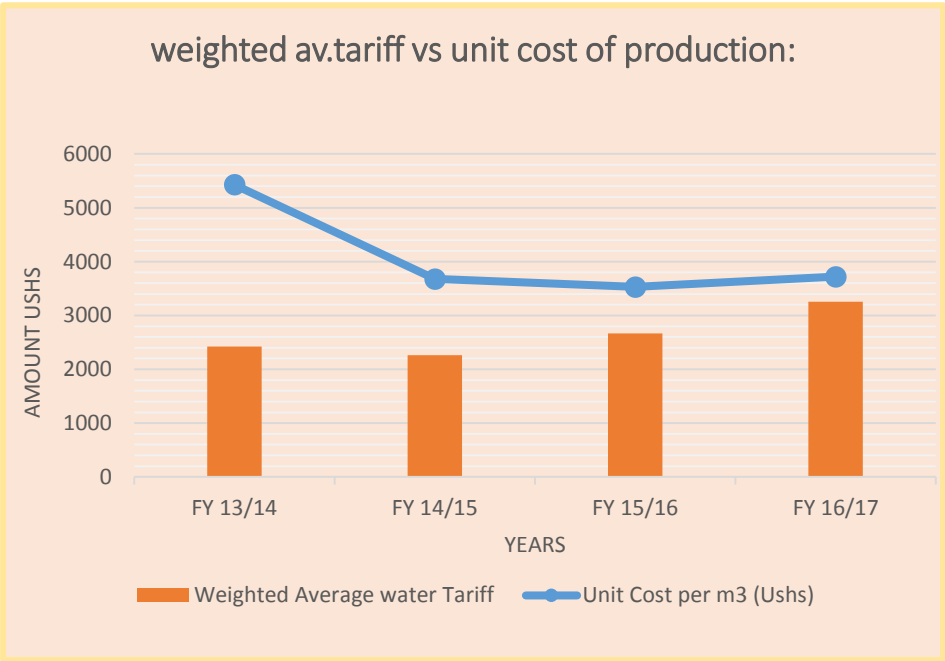

Figure 28: weighted av. tariff vs unit cost of production analysis

[57] KA3 Respondent 3 from Kitgum Area
[58] KA1,KA2, KA3 Respondent 1,2& 3 from Kitgum Area

CHAPTER 6

Discussion and Conclusions

6.1. Phases of water supply service trajectory in NWSC towns

NWSC has undergone several reforms with the cardinal objective of continuous performance improvement and maximization of service provisioning to majority of Ugandans. These requirements were imposed to NWSC with the establishment of the performance agreement the Corporation holds with the Ministry of Water and Environment. Up until recently, NWSC has achieved and sustained these objectives which facilitated its acclaim of being recognized as one of the best performing water utility in Africa ("NWSC Accolades ", 2017). However, at the beginning of the year 2013 NWSC has seen their performance challenged as well as the strategic development and the way the organization arranges daily operations. The reason for this change is the expansion of their mandate from operating only in 23 towns through a profit maximizing angle to a wider service delivery model of expanding services and professionalising the utility countrywide (Mugisha & Berg, 2017). This expansion has been accompanied by a re-alignment of the Corporation's strategic goals with the increased political mandate of meeting GOU national goal of accelerating access to safe drinking water and sanitation service in the urban and rural communities.

In this section I make an attempt at conceptualizing how the political mandate and the corporation's strategic goals work along each other. I propose to understand this process in three chronological phases to understand the development of water supply service delivery in small towns in Uganda under the auspices of NWSC. Based on my focus in understanding the influence of financial sustainability, the importance of infrastructure development and its impact on access, I describe how each and every one of these elements plays a different role in each of the phases and how that is linked to the challenges present in small towns in Uganda, as well as the requirements laid upon NWSC.

6.1.1. Take-off phase: Guaranteeing presence through infra development

During the first phase, taking place just after take-over in 2013, the fundamentals are laid down to prepare water systems in small towns to move along the following phases leading to a reconciliation of NWSC's original objectives of achieving financial sustainability. However, the main visible priority during this phase is infrastructure growth and geographical expansion to increase coverage.

As collected in the Infrastructure Service Delivery Plan (ISDP) report (NWSC, 2015), NWSC expanded 470 km of water mains pipe network. By the end of the financial year (FY) 2014/2015, this figured had increased to 1.448 km. This is a major change from the average annual network extension of 80 km that NWSC had developed in previous years, prior to the introduction of this plan. The expansion of this network, that responds to the take-over in one year of an additional 23 towns (total of 66 owns by FY 2013/2014), translated into increased coverage from 77.5% to 78.5% (NWSC-Annual.Report, 2014).

The rapid expansion of NWSC during this phase is of crucial importance and it serves the Corporation two purposes. First, the rapid expansion, and therefore their compliance with the mandate imposed by the Ministry of Water and Environment allows them to show the Ministry their willingness to provide services despite the challenges, and their capacity to take on more towns despite the immediate burden on the Corporation's performance. This can eventually be accompanied with a, justified, continued lobbying to the Ministry garnering political backing for investment financing for the present and future water projects (Mugisha & Berg, 2017).The expansion of NWSC helps fulfil the political mandate of GOU aimed to increase urban and rural access of water supply services from the 77% and 65% respectively to 100% and 79% by the year 2020 thru household connections and installation of more water points (N.W.S.C-SCAP100, 2016). Second, the increased presence of NWSC in many towns and rapid infra growth is to show to the users that NWSC has the capacity to deliver better services. The presence and immediate improvement of services, allows NWSC to introduce practices such as water tariff and payment requirements that lay the basis to move towards a system that would cover the costs of operations.

a. Relative weight of financial sustainability

At this stage, the financial viability of towns seems to remain important but it is not a priority. More connections are made to increase water sales thus high billing, tariffs are introduced and customers are sensitized to pay for water services to enable the utility generate some funds to cover O&M costs of the system, aspects that point that NWSC never completely abandons being a commercially viable utility. However, and most importantly is the development of infra and takeover of small towns in spite of the related risks of operating in small towns and the challenge of meeting expected high demand for services emanating from operating in a broader community. In addition, satisfying the political mandate is one avenue of seeking for political backing for capital financing. For example, the SCAP100 programme being implemented in all NWSC towns and the construction of the massive Kitagata treatment plant among others that are heavily funded by the GOU are evidences of gained political support for infrastructure financing. The management of NWSC seems to acknowledge these challenges during this phase and chose expansion of the network at the expense of costs because they believed that taking over unviable towns and aggressive network expansion and increased connections, would result into future pay-off in terms of increased revenue (Mugisha & Berg, 2017).

b. Challenges of infrastructure development in small towns also materialize in Uganda.

The rapid expansion of services in small towns translates into an immediate burden to NWSC. the problems that others have identified that affect infra development in small towns such as low economies of scale and densities resulting to high per capita costs of extending services, over designed systems leading to underutilization of production capacities, high costs of investments due to construction of centralized systems and dilapidated infra (WaterAid/BPD, 2010; Mugabi & Njiru, 2006; Adank & Tuffuor 2013; P Moriarty et al., 2002), these challenges also materialize in Uganda. Designs of the water supply systems that provide excess capacity do not always necessarily mean that the bigger the infrastructure the better results it will deliver, especially for small towns. Critics of this approach argue that future demand needs to be projected with certainty but rarely is demand in towns realised due to the peculiar characteristics of small towns being in the rural-urban continuum, therefore errors in projections may turn out to be costly to the utility in terms of investment costs especially when the expected connections are not met (Hopkins et al., 2003; Lauria, 2003).

From the cases of Bushenyi/Ishaka and Kitgum that I have studied I have been able to show how the magnitude of the infrastructure vis-a-vis the slow realization of demands (coupled with other environmental hurdles) translate into a direct burden of the operational expenses of these systems. To re-affirm the importance of the take-off phase NWSC had no choice but to take over water supply systems in towns that are overdesigned. The production plants in my cases are not at full capacity utilization and the situation is worse in Kitgum because capacity utilization is below half the plant production capacity. Such systems have a direct impact on the costs of service delivery in towns. This phenomenon is common with design of urban water system based on national standard designs that assume "bigger is better or cheaper" because of the potential to exploit economies of scale. This assumption is binding for large towns where there are high economies of scale, where average unit cost of production declines with additional production of a cubic unit of water (Ansar & Pohlers, 2014).

The systems in small towns operated by NWSC have been able to overcome these shortcomings, precisely because of being operated under a bigger organization that is able to make ends meet. The burden of striving for a theoretical financial sustainability and 'right pricing' of water is ultimately to translate all costs to the user tariff, and therefore make the consumers bear the costs of producing and distributing water (Zieburtz, 2008). In the case of small towns under NWSC, these costs are recovered through a combination of cross-subsidies established within the system of NWSC by which bigger systems (bigger towns or cities) are able to subsidize with their surplus the funding shortcomings encountered in small towns. In addition to that the investment costs in Uganda are generally borne by the Government of Uganda through either national budget allocation transfers to NWSC or through development projects. Furthermore, the use of cost savings design approaches that can aid the unpredictable population in these towns (Mizutani & Urakami, 2001). NWSC invests on intensification of the distribution pipe network using small diameter pipes of 1inch to 1¼inch together with submains of 2". This is considered to be of high impact to both the utility and benefiting community. It is considered cheaper but effective in extending services to a wider coverage and services are extended nearer to community which also reduces on the connection fees for the consumers.

6.1.2. The Stability Phase: water supply reliability

Upon a strong development of the pipe network in the town, attention is shifted towards guaranteeing reliability of water supply in the town increasingly turning to low costs mechanisms to expand services while sustaining water supply reliability. At this phase it involves gradually reducing capital expenditure on pipe network and focus on improvement of the water sources, rehabilitation of the treatment plants to enhance efficiency in production and network upgrade to increase capacity utilization to improve reliability of services. Reducing costs on pipe network itself is a detriment to the goal of improving access of services as the kilometres of pipe network and new connection established per annum will simultaneously also reduce as seen from the cases. This suggests that the target of NWSC in this phase is to satisfy the existing consumers with improved reliability service levels.

a. Challenges of infrastructure development in small towns also materialize in Uganda.

During this phase, the priority of NWSC is to progressively improve the number of hours per day of supply. Therefore, also moving towards the achievement of other performance requirements laid upon NWSC. Even though the target is 24/7 supply, improvements are targeted to achieve a reasonable '12 hour supply'. Rarely has this target been achieved in towns despite of the interventions, due to hash climatic conditions that are beyond the utilities capacity

to handle that affects the water sources hence service levels have continued to suffer. Here still, interventions with minimum costs are emphasized to stabilize services. When required, short term interventions (quick fixes) are encouraged such as the PIBID project in Bushenyi to maintain the supply. However, due to the capital requirements of these interventions, reliability plans come at a considerate cost (for NWSC, not necessarily the system) making it difficult to strike a balance between improving service level and returning to a low cost operations. Furthermore, the populations in towns has been growing rapidly thus continuous increase in demand for services (UN-HABITAT, 2006). Therefore prioritizing reliability at the expense of access has partially contributed to the low levels of access to services in towns as also pointed out by Mugabi and Njiru (2006), also in Uganda.

b. Emphasis on improved services to transition towards financial sustainability

I argue that this is a complex phase to draw and that therefore it does not have clear boundaries. This phase is a transitionary phase through which NWSC would move through as soon as possible. During such a stability phase continuity of supply will induce the willingness of the existing consumers to pay for improved services and attract more users to connect to the network that will result into increase in revenue. However, reliability of services in towns is still challenging, as the problems of not only adverse climatic variations but also high O&M costs due to old network still persist (Njiru & Sansom, 2002). This has led to increases of the operational expenditures to levels whereby if NWSC HO was not shouldering some of the costs, service delivery would be worse. Hence towns still find it difficult to guarantee reliable water supply and this has also been increasingly reflected in the feedback from the customer satisfaction survey conducted by NWSC (NWSC-CSS.Report, 2015). This partly contributing to the low willingness to pay and attract more consumers to connect to the unstable pipe water supply. The situation is also made worse by the fact that consumers are surrounded with alternative sources of water which are free but heavily polluted.

Though, the continuous network upgrade to reduce on “dry zones” has stabilized service to some extent and has allowed the utilities to maximise on water sales that eventually increased billing putting the utilities on the pathway of being financially sustainable. Key agenda in the stability phase is continuity of service at minimum costs to increase water sales and billing from the enlarged happy customer base. This phase would therefore be characterized by promotion of customer satisfaction, through improved services, in order to rapidly move towards financial sustainability, therefore this last one gaining clear importance over time.

6.1.3. Landing phase: the ultimate goal financial sustainability

Having improved services, although not everywhere and to everybody, the present and future ultimate goal of service delivery in towns is what I call the ‘Landing phase’, in which all efforts are geared towards achieving financial sustainability. In this phase, the objective is enhance the viability of towns as also directed by the constitutional mandate of operating as a commercially viable entity (NWSC-ACT, 1995). Focus of NWSC is to improve operational efficiency through optimizing operational expenditures and improve revenue collection efficiencies to increase the net cash flows in order to steer utilities in towns to the pathway of being self-reliant for sustainable provision of services. The decision to prioritize viability is because NWSC has limited options of sustaining services in towns, whereas the mandate was expanded but the financial conditions in the performance contracts with the MWE have not been revised and yet political demand and public expectation for improved services have drastically increased.

Therefore they are left with no choice but to introduce business minded aspects in the provision of services.

a. Required reinterpretation of financial sustainability

Once again realizing that small towns are unviable in the short term and indeed difficult business ventures as many have already highlighted (Adank, 2013; Mugabi & Njiru, 2006; WaterAid/BPD, 2010). As an alternative, NWSC is providing a new understanding of financial sustainability. In this understanding they implicitly accept that local billings generated in towns should be sufficient to cover Opex only, depreciation and remain with some surplus that can be ploughed back for minor investments, but putting additional requirements to small towns does not deliver results. This is contrary to the generally acceptable interpretation where by utilities are urged to generate funds that are sufficient to cover its investment costs, O&M costs and environmental costs(OECD, 2010; Zieburtz, 2008). This reinterpretation is only possible in Uganda as funding for capital expenditure in towns are subsidized from NWSC HO, the Government of Uganda or development partners.

In view of steering town's utilities to the trajectory of being viable NWSC uniform tariff structure is set up in such a way that, tariff alone is able to recoup the operational expenditures, depreciation and remain with some operational surplus. This confirms the customary problem faced by utilities in towns of not being able to charge the a tariff that would allow to fully operate as single entities (UN-HABITAT, 2006; Zieburtz, 2008). However, NWSC argues that charging a full cost recovery tariff of water would increase water price by more than 100% across the tariff categorization making it very expensive for ordinary citizens to afford and inequity of services (NWSC-Annual.Report, 2016). Due to the relatively higher cost of production in small towns, as corroborated in the cases of Bushenyi/Ishaka and Kitgum, pushing for full cost recovery would only but damage the sustainability of services further. The users would be burden even more with higher prices, which could potentially lead to less payments and dissatisfaction with the services (Jaglin, 2002). The re-interpretation of cost recovery for small towns as done in Uganda seems to indicate that a compromise in the understanding of full cost recovery is necessary for specific contexts. Judging by the improvement in operation and financial performances of the two cases studied, not charging full cost recovery tariffs, or 'right tariff', does not necessarily lead to poor performance. The implementation of incentives to these small towns and the sharing of responsibilities among levels of operations (between HO and areas) could indicate that there are other ways of promoting 'sustainable operations' besides solely pricing practices. Although full cost recovery tariff is deemed necessary because the utility would have sufficient finance to meet with easy its short and long term obligations (Cosgrove & Rijsberman, 2000:2)

b. Returning back to demand-driven approach to guarantee financial sustainability

To revert NWSC to its constitutional mandate, demand driven approaches of infrastructure development are preferred over supply driven as it reflects a business context of service delivery. This approach allows the utility to meet the actual demand for services but not the unpredictable future demand common in towns. Thus the utility is able to guarantee that water is sold and will generate revenue, which will recover O&M costs. Even while designing the pipe network as practiced in NWSC Bushenyi, allows the pipe network to be developed in phases that meets the current demand, this reduces the initial investment costs and gives the utility the opportunity to progressively plan to expand the network that meets the future

demand. This model of design of systems is embraced in towns water supply systems because it narrows the gap between the cost of the system and revenues to be generated (Hopkins et al., 2003; Lauria, 2003). Therefore to develop the infrastructure will require less start-up Capex and the utility is able to generate revenue from the already existing demand to cover O&M cost from the commencement of the operations but if the start-up Capex is high and given that customer base in towns are usually low, demand and revenues will not be realised in the short run to meet these costs thus unviability (Kessides, 2004). This obviously encourages an implicit selection of customers and makes a distinction between those who can and those who cannot pay for services or are able to upfront the funds to afford the connections.

However, a consideration of the local condition in the design approaches and technologies adopted for town system is important and it depends upon those who use it (Pilgrim et al, 2004). For example in Kitgum area, where designs of pipe network are based on projected growth, differently from Bushenyi, there are slower in realizing 'adequate' working rations but they show the same positive trend as in the other case. This shows that design approaches of infrastructure within small towns is not universal thus highlighting one more time the complexity of providing services in these towns.

6.2. Conclusion

In conclusion, aggressive infrastructure development affects financial sustainability and service levels in towns at the different phases of service delivery with varying magnitude of consequence given that there are different levels of priorities and importance in each phase. Although the aspects of infra development, service levels and financial sustainability are considered in each phase, the degree of priority and importance differs. At the takeoff phase, coverage/access to services is the cornerstone of the phase because the focus of NWSC is to effectively expand services through network extensions and geographical coverage to increase the customer base thru new connections and public stand pipes thus increase visibility of NWSC as well as fulfilling the political mandate. Although less attention is given to viability of the utilities in small towns at this stage but it is as well important because some aspect of efficiency service provision is introduced. In the stability phase service reliability with a quick transition to financial sustainability is promoted, the intervention carried out to stabilize services are carried out with minimal costs from the operational budgets except for special cases. Though there is a challenge of striking a balance between services levels and costs thus complicating the phase. The landing phase, being financially sustainable now and in the future is key priority over service levels hence the emphasis of improving the operational efficiencies of utilities by optimizing operational expenditures and rapid increase in revenues. Focus on demand driven approaches of infra development with a business mind that brings some cost savings and reducing on the unit costs of production are aspects of returning NWSC to its mandate. This approach will allow the utility generate some surplus that can be ploughed back for investments in the future. It's a paradox to provide services in towns, tinkering with one indicator consequently affects another that explains why NWSC choses to give different levels of priority to the performance indicators in the phases of service delivery. This is the extent of how infra growth has affected financial sustainability and service levels in town's water systems. The diagram below shows how I have conceptualized the relationship of the three chronological phases of service delivery in the towns

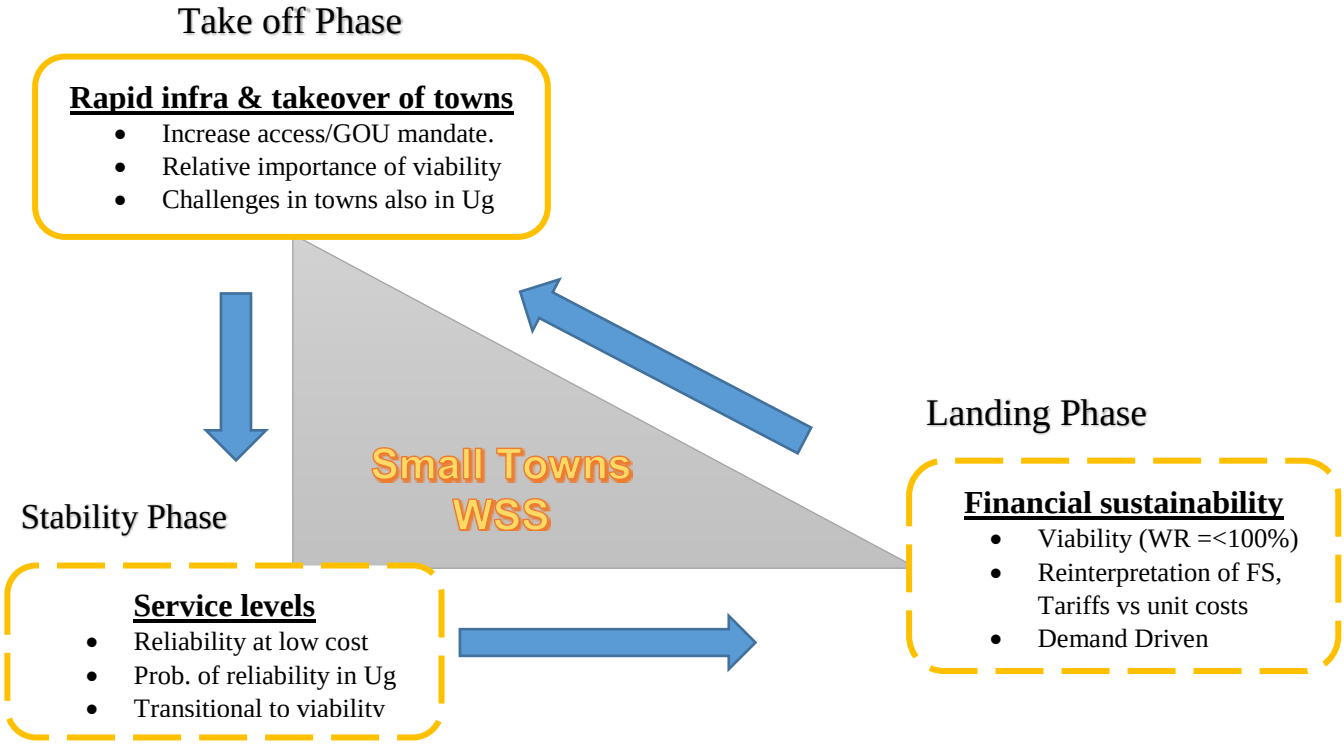

Figure 29: Phases of water supply provision in Towns

6.3. Recommendations

As requested. there is still need for GOU and NWSC HO to continue supporting small towns with investment subsidies for capital expenditure to levels where towns can be self-reliant as being encouraged (Cardone & Fonseca, 2006). Because the risks of providing services in towns seem to be overwhelming than the returns if the end goal is for towns to be viable. For this reason, NWSC needs to explore other investment financing options such as market financing that can quickly boost town's financial strength rather than relying only limited options of external support. For reasons as others have claimed that financial aid for capital investments for the water sector from external funders has continued to decline as funds from government and donors are unreliable thus the urgent need for town utilities to be financially sustainable (Cardone & Fonseca, 2006; OECD, 2010). Hence with the tariff in place that recoups O&M costs, depreciation and some surplus income for minor investments utilities in towns should be tasked to generate sufficient revenues to sustain their operations without depending on external support as a minimum requirement within a specified period of time. This is the desired arrangement of financial sustainability curve being pursued by NWSC as exhibited in the two case study utilities with its cross subsidy model although uncertainty still lingers on the sustainability of this model in water service provisioning for towns.

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APPENDIX

Appendix A: Respondents interviewed and the codes

No.	Station	Name	Position	Codes
		NWSC HEAD OFFICE		
1	NWSC Hqtr	Eng. Alex Gisagara	Director Engineering services	Hq1
2	NWSC Hqtr	Eng. Lawrence Muhirwe	Sn. Manager Operations N&E region	Hq2
3	NWSC Hqtr	Prof. Mahmood Lutaya	Sn. Manager Operations S&W Region	Hq3
4	NWSC Hqtr	Mr. Silver Emudong	Sn. Manager Finance and Accounts	Hq4
5	NWSC Hqtr	Mr. Jude Mwoga	Sn. Manager Programmes and Performance Monitoring	Hq5
6	NWSC Hqtr	Eng. Denis Taremwa	Manager Water supply Infrastructure Dev't	Hq6
7	NWSC Hqtr	Eng. Cyrus Aomu	Principle Eng. Planning and Capital Dev't	Hq7
8	NWSC Hqtr	Aaron Magara	Regional Engineer N&W region	Hq8
9	NWSC Hqtr	Geoffrey Dwoka	Regional Engineer N&W region	Hq9
		BUSHENYI/ISHAKA OPERATIONAL AREA		
10	Bushenyi/Ishaka	Francis Kateeba	Area Manager	BI1
11	Bushenyi/Ishaka	Rogers Mugabe	Area Engineer	BI2
12	Bushenyi/Ishaka	Francis Oluka	Area accounts Officers	BI3
13	Bushenyi/Ishaka	Owona John Bosco	Branch Manager Ishaka	BI4
14	Bushenyi/Ishaka	Alex Ashababahebwa	Commercial Officer Billing/Revenue	BI5
15	Bushenyi/Ishaka	Peter Engwanyu	shift overseer	BI6
16	Bushenyi/Ishaka	Mr.John	Plumber	BI7
		KITGUM OPERATIONAL AREA		
17	Kitgum Area	Faith Nambuya	Area Manager	KA1
18	Kitgum Area	Samson Munanura	Area Engineer	KA2
19	Kitgum Area	Patrick Opio	Area Accounts Officer	KA3
20	Kitgum Area	Fred Bongomin	Commercial Officer Billing/Revenue	KA4
21	Kitgum Area	Moses Okello	Plant Operator	**KA5**
22	Kitgum Area	Owona B	Plumber	**KA6**

Appendix B: interview guiding questions

B1: Questions for respondents from NWSC Head office

General Questions: To what extent has infrastructure development affected financial sustainability and Service delivery in the context of small town's water and sanitation systems?

1. How does NWSC define a 'small Town's water and sanitation service?
2. What infrastructural development policy frameworks are there for small town's water and sanitation services?
3. What financial policies and mechanisms are in place to ensure sustainable provision of water supply services in small towns?
4. How is the government supporting small town's water supply services?
5. Who else is funding small town's water and sanitation services? What do they fund?

Research Questions	Questions	Summary of Responses
How are, the current infrastructural development approaches in small towns established and who takes decisions?	• How is, the infrastructure in small towns developed? • What is the preferred infrastructural service delivery models in towns? And why? • What data is available at the phase of design of the water supply system? • What are the current design approaches for the water supply systems in small towns? How and where do they take place? • How is infrastructure need determined and how are costs estimated? • On what basis are the designs for the water supply system based on? (System boundary limits, growth projections, demand studies?) • How does the infrastructure development respond to the pressure of demand for services in towns • Who are key stakeholders in the development of infrastructure for small towns and why? • Where do the designs come from? Who is responsible? • Has the infrastructure development achieved the intended objective and at what costs? • Has the infrastructure developed in small towns realised the economies of scale/densities? If not why not? If yes kindly explain	
What are the revenue estimates generated from capital expenditure (Capex) and operation and maintenance expenditures (Opex) in small town water utilities? What are practices and measurement of financial sustainability?	• From where do the funds for Capital expenditure (Capex) in small towns come from? • What is considered financial sustainability in NWSC and how is it measured? • How is financial sustainability translated into small town utility operations and what are some of the practices that are exhibited? • How are the finances for capital expenditure for small towns allocated, based on what criteria? • What costs are utilities in small towns expected to cover? And through which means? • Who meets the operations and maintenance expenditure of utilities in small towns? • In case of a shortfall of revenues against O&M costs how is the difference covered and how do the utilities negotiate with head office to ensure continuity in supply • What happens in case there is a surplus of revenues from small towns? How is it managed? • Who and how are the tariffs set for small towns, what costs does the tariff recover (investment or O&M or both?) • Where do you see small towns financial sustainability strife in the future	

How do the service levels suffer or not from the infrastructure development approaches of water utilities in the small towns?	• How are the utilities in small towns performing in terms of access and reliability of water supply services • Have utilities in small towns been able to improve service levels amidst financial challenges? explain • Why are services still not adequate in small towns despite of injection of funds to small towns • What is the relationship between financial strength of the utility and the level it provides services • How Has the viability of utilities contributed to the levels of services offered	

B2: Questions for respondents from NWSC Bushenyi/Ishaka and Kitgum Areas

General Questions: To what extent has infrastructure development affected financial sustainability and Service delivery in the context of small town's water and sanitation systems?

6. How is the general water supply situation in the towns of Bushenyi/Kitgum?
7. What infrastructural development initiatives have been undertaken since 2014 to improve water and sanitation services?
8. What financial policies and mechanisms are in place to ensure sustainable provision of water supply services in small towns?
9. How is the local government supporting small town's water supply services?
10. Who else is funding small town's water and sanitation services? What do they fund?

Research Questions	**Questions**	**Summary of Responses**
How are, the current infrastructural development approaches in small towns established and who takes decisions?	• How is, the infrastructure in Bushenyi/Kitgum developed? Who initiates the process, who decides? • What type of infrastructure and technology is used to extend services? • What data is available at the phase of design of the water supply system? • What is the current design practice for the water supply system here? How is it done? • What is the design capacity of the treatment plants? Is it fully utilized? What are the limitations? What is being done to rectify? • Have there been network extensions of OD90 and above? If yes, where? What was the goal? Who sanctioned it? • What has been the impact of the network extensions? • How is infrastructure need determined and how are costs estimated? • On what basis are the designs for the water supply system based on? (System boundary limits, growth projections, demand studies?) • How does the infrastructure developed respond to the pressure of demand for services in towns • Who are key stakeholders in the development of infrastructure in the towns and why? And their roles • Where do the designs come from? Who is responsible? • Has the infrastructure developed achieved the intended objective and at what costs? • Has the infrastructure developed been beneficial? If not why not? If yes kindly explain. Who has benefited and how?	

What are the revenue estimates generated against capital expenditure (Capex) and operation and maintenance expenditures (Opex) in small town water utilities? What are practices and measurement of financial sustainability?	• How is financial sustainability perceived in the area? • From where do the funds for Capital expenditure (Capex) in small towns come from? • What are the actual costs of investments on production plants and distribution network since 2014? • What are the actual O&M costs for the infrastructure developed • Who generates the budget for Capex? Based on what data? • What are the revenues generated from the investments? Any other sources of revenue? • How is, revenue collection managed and what is the collection efficiencies of the utility? • What efforts are in place to ensure that the largest percentage of billed revenues are collected? Why put effort on collection efficiency? • Is the utility projecting an increase or decline in revenues and by how much? • What costs are utilities in small towns expected to cover? And through which means? • How are O&M costs met? From which budget or allocation? • In case of a shortfall of revenues against O&M costs how is the difference covered and how do the utilities negotiate with head office to ensure continuity in supply • What happens in case there is a surplus of revenues? How is it managed? • Where do you see small towns financial sustainability strife in the future	
How do the service levels suffer or not from the infrastructure development approaches of water utilities in the small towns?	• Who is served and at what service level? • To what extent has the utility been able to increase coverage/access? • Any plans to expand services, to who and why? • Why is coverage/access still not 100% despite the development of infra • How Has the viability of utilities contributed to the levels of services offered • How many hours per day is service available for consumers? • What is causing unreliability of services • How has the utility been able to sustain service delivery? • How are service levels of access and reliability measured? Why is it important	

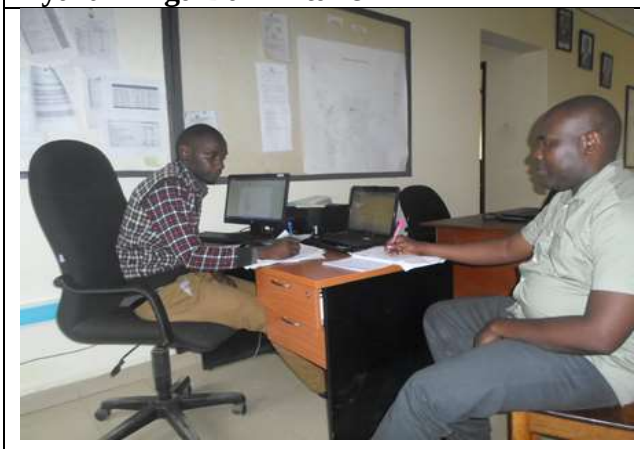
Appendix C: Photos from the case study towns of Bushenyi and Kitgum

C1: Photos from Bushenyi/Ishaka Operational Area

Aeration treatment process

PVC Pipes for mains extension

Nyarunzinga Dam intake



Interview Area Engineer Bushenyi

Interviewing Area Manager Bushenyi

C2: Photos from Kitgum Operational Area

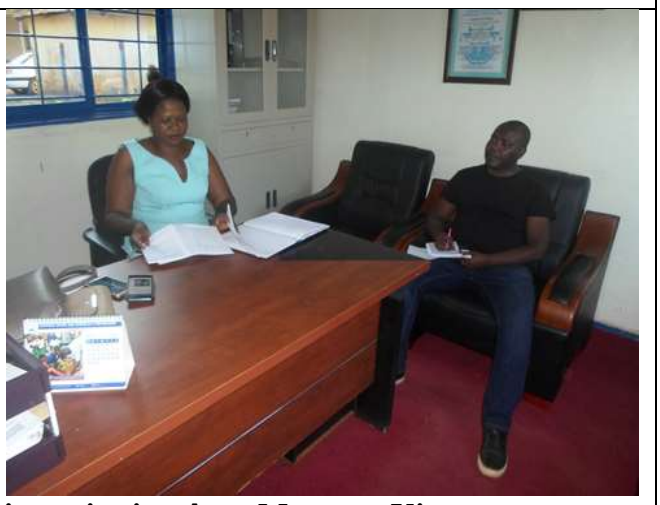
Borehole pumps PTC pump stations

NWSC Plumbers Reconnecting a customer

Hilltop Pumping station Kitgum

Alternative sources of water

interview with the plant operator Kitgum



interviewing Area Manager Kitgum

Appendix D: MSc. Thesis supervision Agreement

MSc Thesis Supervision Agreement

Academic Year 2016/2018

Water Management & Governance Programme, IHE Delft

Status of the thesis contract

- The research supervision agreement formalises the agreement the student has made with the thesis mentor and supervisor. In this sense, it is a supplement to and elaboration of the rights and obligations that the parties have, based on the roles and responsibilites laid out in the Student Handbook.

Filling in and signing the agreement

- When the supervision team is formed, the student and the thesis mentor and supervisor fill in this form and sign one copy.
- The student will attach a copy of the agreement as an Annex to the proposal. The research proposal will not be approved without this agreement.
- It is recommended that each member of the supervisory team retain a copy of the final agreement, as a reminder of the roles and responsiblities discussed and timetable agreed.
- Changes to the original agreement need not be resubmitted, unless one of the members of the supervisory team changes.

Problems and complaints

If the student has any problems or complaints regarding supervision or evaluation, he/she can contact:

- his/her supervisor (professor)
- the MSc research coordinator of the WM programme (Michelle Kooy, m.kooy@un-ihe.org)
- the Programme Coordinator (Ilyas Masih, i.masih@un-ihe.org)

Important dates/deadlines

- MSc thesis research proposal: 13 October 2018
- MSc research proposal defenses: 16-20 October 2018
- Progress report by supervisory team to MSc coordinator: 31 January 2019
- Back from the field presentation of data: *to be announced*
- Submission of first full draft of the thesis to supervisory team: 28 February 2019
- MSc thesis deadline: last week in March 2019 – to be announced

1

I. General Information

Programme	MSc WATER MANAGEMENT - WATER SERVICES MGT
Student name	MAXI JULIUS OMUUT
Student Number	1017207
E-mail	omuut1@un-ihe.org
Mentor *(program)*	MIREIA TUTUSAUS LUQUE
Professor *(program)*	PROF. MARGREET ZWARTEVEEN.

II. General description and time-scale for the thesis

• Subject:	Analysis of Infrastructure development Dynamics in water Supply Services for Small towns
• Planned starting date of the fieldwork:	1st Nov. 2017
• Special circumstances concerning planning	
• Planned completion date of the thesis	30th March 2018
• If this thesis is part of a larger project: specify what costs of the MSc research are paid for by the project	ALL Costs
• The thesis supervision is part of a MSc research cluster coordinated by:	Ass. Prof. Klass Schwartz.
• Identify the fellowship scheme of the student, if relevant to MSc research (funding, fellowship requirements)	
• Specify the allocation of supervision hours between the mentor and the Professor (total allocation of 80 hours)	

2

Time-scale of different activities (including proposal writing milestones such as literature review, problem statement, RQs, methodology etc; MSc cluster meeting, reporting requirements of the student while in the field, progress reports, other)

Activity	**Planned time**
Deadline - student completes first draft of thesis proposal outline	
Deadline - student completes final draft of thesis proposal outline	
Deadline - student completes full draft of proposal	

III. Agreements regarding format and schedule for supervision meetings
(preparation required of the student in terms of written deliverables, format/style of feedback from supervisor team, planned absence of members of the supervisory team to be taken into account, participation within a cluster, other)

IV. Agreements regarding ownership and use of the research data: The mentor and supervisor agree that the student has ownership over the research data collected as part of their MSc thesis. Any publication of the data will be done with the persmission of the student, and authorship of any publication will follow the IHE-Delft rules for authorship of manuscripts as written down in UNESCO-IHE Policy Note PN/01/2012 of March 7, 2012.

Signing the agreement

13th/10/2017
Date *Signature (Student)*

13/10/2017
Date *Signature (Thesis Mentor)*

Date *Signature (Thesis Supervisor)*

Attach a signed copy of this form to the MSc research proposal, and retain a copy for each member of the Supervisory team.

4

Personal Declaration of Responsibility – Research Ethics

I declare that I am cognisant of the goals of the "AISSR Ethical Procedure and Questions" that aim to make me think through and make explicit how my research plans will lead to good research, not only in a methodological sense but also in the ethical sense.

I subscribe to the principles of:

- voluntary participation in research, implying that the participants might withdraw from the research at any time.
- informed consent, meaning that research participants must at all times be fully informed about the research process and purposes, and must give consent to their participation in the research.
- safety in participation, meaning that the human respondents should not be placed at risk or harm of any kind e.g. research with young children.
- privacy, meaning that the confidentiality and anonymity of human respondents should be protected at all times.
- trust, which implies that human respondents will not be respondent to any acts of deception or betrayal in the research process or its published outcomes.

Date and student's signature