

Sanitation infrastructure transformations in a small town: the case of Bushenyi-Ishaka, Uganda

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Sanitation Infrastructure Transformations in a small town: the case of Bushenyi-Ishaka, Uganda.

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Abstract

The sanitation ladder has been advocated as a measure of sanitation progress by the World Health Organization and Joint Monitoring Program. This teleological narrative portrays the ascension process as unilinear with everyone eventually connected to a water borne system. However, infrastructure is not linear. To the contrary, infrastructure is a process with setbacks and intermittency. A community can lose its infrastructure due to migration war, extreme weather conditions, lack of maintenance or/and inability to pay for services.

This study has looked at how sanitation infrastructure has transformed with time, in households and institutions in Bushenyi-Ishaka. The study also sought to understand the different drivers associated with sanitation infrastructural changes. Primary and secondary data sources were used for data collection with a focus on oral history interviews, semi-structured interviews and unstructured observations between January and February 2019.

While it is evident there was a change from open defecation to latrine construction and use due to enforcement of state rules, the subsequent upgrade and improvement of sanitation infrastructure was due to choice and financial ability. Availability of water was a contributing factor towards change however this did not assure effective use of the flush toilets as their use was limited to night and during the rainy season. The empirical findings also validated that infrastructure transformation is not a unilinear process as portrayed by the sanitation ladder as community members make innovations and changes so as to enjoy the benefits that come along with having a sanitation facility. Infrastructure development is unequal as community members are investing in sanitation infrastructure which is affordable to them and not all can afford the same changes. Institutional sanitation infrastructure has also transformed with time to accommodate the high enrolment of students, the rate of change is dictated by parents and the local government.

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Abbreviations

EAWAG: Swiss Federal Institute of Aquatic Science and Technology

JMP: Joint Monitoring Program

MDG: Millennium Development Goals

MOH: Ministry of Health

SDG: Sustainable Development Goals

UGX: Uganda Shillings

UBOS: Uganda Bureau of Statistics

UNDESA: United Nations Department of Economic and Social Affairs

UNICEF: United Nations Children's Fund

WHO: World Health Organization

Chapter 1

Introduction

1.1 Background

The sanitation ladder whose roots are in rural participatory methodologies is used by development literature to measure progress in sanitation (Potter, et al., 2011). The progress is assessed on prescribed technological options with an overall aim of everyone using safely managed improved sanitation facilities (WHO, et al., 2017).

The progress evidenced by “climbing” the sanitation ladder is disaggregated in distinct rural and urban areas missing out on intermediary scales such as small towns, which are home to one third of the global urban population (UNDESA, 2010). Small towns may be associated with delayed or unattained targets due to unavailability of development indicators to track progress as towns are characterized as either urban or rural. With the focus on Sustainable Development Goal 6 (SDG) ambitious target of ensuring equitable access to safely managed water and adequate sanitation for all and end open defecation, the Joint monitoring program(JMP) estimates that 1.7 billion people with safely managed sanitation were urban dwellers and 1.2 billion people with safely managed sanitation were rural dwellers (WHO and UNICEF, 2017). Small towns are not captured within such statistical assessment leaving out a large proportion of the population living in the rural urban continuum (Satterthwaite, 2016).

However, the visual representation of the sanitation ladder as a unilineal path is limiting as it tends to represent sanitation infrastructure as a complete artefact not liable to loss, damage and poor maintenance. The reverse is true as infrastructure is precarious and is subject to malfunction, damage and loss due to various factors. Ascending the ladder on predetermined terms and conditions is not a straightforward process especially when it comes to a user whose preference is a ventilated pit latrine to a flush toilet due to intermittent water supply and high operation and maintenance costs (Potter, et al., 2011). Water intermittency and limited access to waste disposal ,electricity and schools are some of the basic services that the communities in small towns are disadvantaged from enjoying (Cohen, 2006).

The stepwise ladder tends to appeal to households to ascend a ladder with pre-determined technologies that do not necessarily reflect the needs of small towns due to their uniqueness of being in the rural-urban continuum (Hopkins, et al., 2003). The necessity of climbing up the ladder for improvement of one’s condition while incurring additional costs does not take into account funding or income restrictions and may not be instinctive to other cultures (Kvarnström, et al., 2011).

Moreover, the sanitation ladder, does not take into consideration how asymmetrical power relations can prevent a community from accessing sanitation infrastructure. Besides, it does not recognize how sanitation infrastructure is tinkered and tampered with to suit the users' needs especially in small towns where sanitation has not been a top priority due to the complexities associated with the sanitation services as a result of multiple actors involvement along the sanitation service chain (Luthi, et al., 2017). Despite the availability prescriptive literature on sanitation, there is limited literature on the transformations of sanitation infrastructure from the user perspective.

The study focused on a town in Uganda called Bushenyi – Ishaka which is located 324 kilometres from Kampala city on the Kampala -Mbarara– Kasese high way and in the South-western region of Uganda as shown in Figure 1. The Municipality is the main commercial centre and houses the political and administrative headquarters of Bushenyi District (Dauda, et al., 2017). The municipality has three divisions, 15 wards or parishes and 73 cells or villages. Bushenyi-Ishaka Town Council was elevated to a municipal council in 2010 after merging Ishaka and Bushenyi towns and adding the parishes of Kashenyi, Mazinga, Ruharo, and Rwenjeru. There has been a consistent population increase in the municipality from 14,195 in 1991 to 41,063 in 2014 (UBOS, 2016). The town is also experiencing economic growth due to its strategic location on Mbarara - Kigali - Fort Portal cross roads and numerous feeder roads linking up all parts of greater Bushenyi's rich agricultural hinterland(Dauda and Gerald, 2017). The town relies on agriculture, commerce, construction and agro-processing industries as economic activities. Historically, the two towns Ishaka and Bushenyi trace their roots along trading routes from the mineral rich Kasese when Indian merchants came and established shops in the early 1950s.

The recent elevation to a municipality status enabled the categorization of the town as an “urban and peri-urban area”. Urban areas are mainly areas with close proximity to basic services like electricity, water connection, school, health services. Development¹ in the urban areas include business buildings, schools and hospitals. There is also a limitation to farming in the urban areas unless it is authorized. Peri-urban areas are areas located in the periphery of the municipality with limited basic services such as schools, health services with small residential houses as part of the development. There is dominance of farming for both subsistence and commercial purposes.

There is limited information on the history of sanitation infrastructure, the only available information is statistical and shows a decrease in sanitation coverage which applies to Uganda as a country. This study looked at the messy and non-linear character of sanitation infrastructure transformations across time with an aim of challenging the narrative of the “sanitation ladder”.

¹ Process of adding value to an area physically, environmentally, socially, and economically by constructing new buildings, putting up good roads, availing water supply and health services.

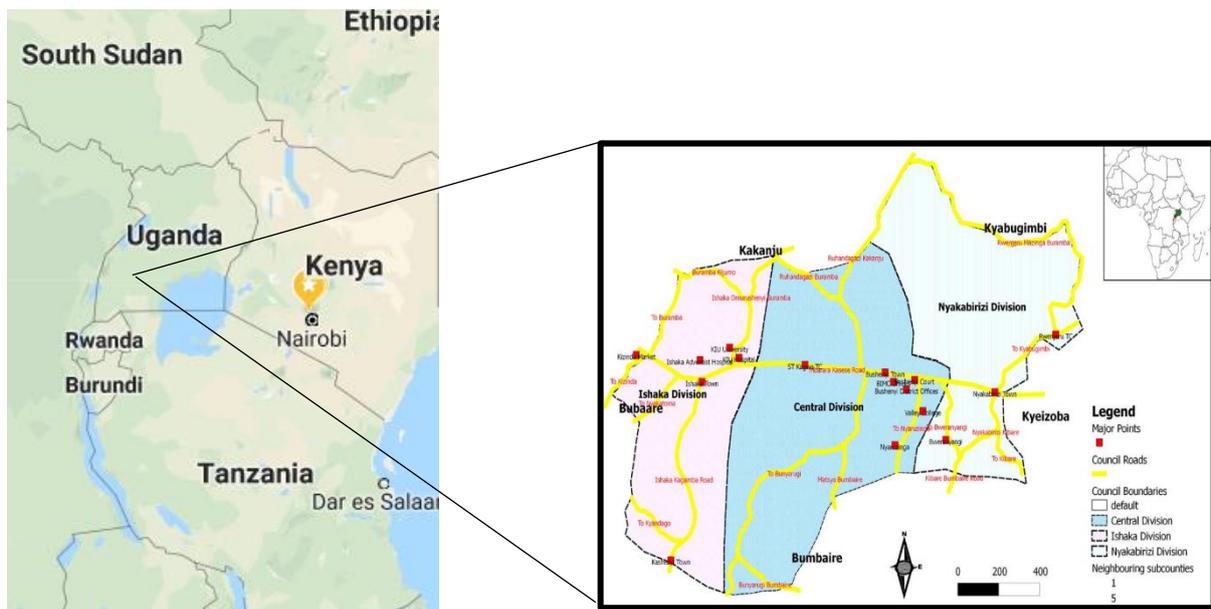


Figure 1- Map of Uganda and the study area of Bushenyi –Ishaka municipality

Source: [<https://www.google.com/maps>,(Nyakutsikwa, 2018)]

1.2. Problem Statement

Sanitation services have transitioned over the years from being regarded as a basic need by the development agencies and different countries, to a more contemporary debate that includes calls to take into account sustainability (Rosenqvist, et al., 2016). Each sanitation-related state reform is likely to result in a change in sanitation coverage as countries apply different strategies and implement different interventions. Coverage, however does not give an indication of the details of infrastructure transformation. Uganda has recorded a gradual decline of open defecation from 20% to 6.1% in a span of twenty years (UBOS, et al., 2018, Uganda, 1995). This improvement is national and mostly is disaggregated according to urban and rural populations and does not give a representation of what happens in small towns which are classified as towns in the grey area as they have both rural and urban characteristics. Sanitation in small towns had not been foregrounded by most donor agencies and the development communities until recently due to lack of capacity, unclear mandates, low budgets and lack of feasible options (Thomas, et al., 2015). Whilst provision of services has often been overlooked, small towns are slowly gaining recognition and importance due to the high rate of urbanization and hence the need to develop specific approaches that reflect their unique characteristics. This recognition has resulted in a change of research agenda in small towns as there are studies underway to understand the water and sanitation situation on the ground with an aim of identifying appropriate sanitation management models in small towns (Luthi, et al., 2017). The water agenda has been promoted in small towns as it forms part of the definitions adapted for small towns, however there are minimal efforts going towards sanitation especially since there have not been any studies done to understand the transformation of sanitation infrastructure. A recent

study was done to understand the current sanitation situation in Bushenyi-Ishaka Municipality one of the small towns in Uganda. The sanitation coverage was estimated at 85% for pit latrines and 13% for septic tanks (Nyakutsikwa, 2018). This coverage however does not reveal the sanitation infrastructure transformation process across time. There is also limited information on sanitation infrastructure transformation from the user's perspective in comparison to transformation of water infrastructure. This forms the basis of the study as it looks into how sanitation infrastructure has been transforming in Bushenyi-Ishaka Municipality with an aim of complicating the sanitation ladder as a measure of "sanitation progress and development".

1.3. Research Aim

To systematically reconstruct sanitation infrastructure transformations in order to complicate the sanitation ladder narrative

1.4. Research Questions

1. What are the different sanitation infrastructure that have been in use through the years in Bushenyi-Ishaka Municipality?
2. What are the drivers of sanitation infrastructure change in both past and current practices in Bushenyi-Ishaka Municipality

1.5. Research Objectives

1. To document how sanitation infrastructure and practice has changed through the years in Bushenyi-Ishaka Municipality
2. To explore the drivers of sanitation infrastructure change both in past and current practices.

1.6. Structure of the Thesis

The thesis will be divided into seven chapters. :

Chapter 1 will introduce the roots of the sanitation ladder with a focus of how small towns have been exempted from indicators that measure progress due to them of having both rural and urban characteristics. The chapter also highlights the context of the study and the existing problem which the study aimed at providing answers to. The research aims, objectives and questions are also presented in this chapter.

Chapter 2 is where the global, regional and country specific sanitation status are presented. It also describes in detail the ladders and narratives used to measure progress in the literature. The chapter also introduces various infrastructure related concepts that are important lenses of analysis.

Chapter 3 is the methodology section where the research design, sampling strategy, data collection methods and analysis are presented.

Chapter 4 and **Chapter 5** present the results section which are organized in chronological order with an aim of capturing the different types of infrastructures that have been in use in the municipality. In each of the chronological chapter, a brief historic account will be provided to enable the reader familiarize with the context.

Chapter 6 presents the drivers of sanitation infrastructural change and discusses them.

Chapter 7 presents the discussion and conclusions: arguments based on the results are supported by relevant literature.

Chapter 2

Literature Review

Global, regional and country specific sanitation status are presented. It also describes into detail the “ladders” and narratives used to measure progress in the literature. The chapter also includes various infrastructure related concepts that are important lenses through which the analysis is made.

2.1. Importance of Sanitation

Sanitation is the access to and use of facilities and services for the safe disposal of excreta. Safe sanitation is paramount for human health as it not only prevents infection but also contributes towards human comfort, dignity, and safety (WHO, 2018). Poor sanitation is a contributing factor to diarrhoea, a leading cause of disease and child mortality among children under five years. An estimated 280,000 deaths in 2012 were as a result of diarrhoea in low and middle income countries (Prüss-Ustün, et al., 2014). In 2016, diarrhoea was among top ten leading causes of deaths with an estimated 1.6 million deaths (Naghavi, et al., 2017). About 90% of deaths in South Asia and sub-Saharan Africa were attributed to diarrhoeal diseases with children under five as victims (Naghavi, et al., 2017). A study in Brazil identified low socio economic status, availability of intestinal parasites and absence of prenatal examination as contributing factors to diarrhoea and concluded the importance of interventions that do not only improve sanitation but also general living conditions (Genser, et al., 2006). Neglected tropical diseases which are linked to poor sanitation cause more than half a million deaths annually and are among the top ten leading causes of life years lost to premature deaths and disability (Hotez, et al., 2007a, Hotez, et al., 2007b).

Further to the health impacts, improved sanitation results in both economic and social benefits. Uptake of sanitation solutions is associated with privacy, convenience, prestige and modernity in the community (Mara, et al., 2010). In addition, access to household facilities promotes well-being in women as it reduces crime and sexual harassment at night when going to public latrines or when going to defecate in the open (Hutton, et al., 2016). Provision of school sanitation facilities do not only increase school attendance and performance among girls but also increases school enrolment among younger children of both genders (Adukia, 2012, Hutton and Chase, 2016).

Improved sanitation is directly linked with economic benefits as it reduces: days lost at work due to illness or when caring for an invalid and time poverty (queuing time lost while using shared latrines or walking long distance looking for a relatively safe place to defecate) (Mara, et al., 2007).

Globally, 68% of the population have access to basic sanitation, 39% have access to safely managed sanitation and 892 million people practice open defecation as shown in (Figure 2). Despite the current high number of open defecators, there has been progressive decline in open defecation from 1229 million to 892 million within a fifteen year period (2000-2015)(WHO and UNICEF, 2017). However, sub-Saharan Africa registered an increase in open defecation from 204 to 220 million due to the high population growth experienced(WHO and UNICEF, 2017).In Africa about 30% of the population has access to improved sanitation, half of the population relies on pit latrines and 34% practice open defecation while 70 % of the population in sub-Saharan Africa lack access to basic sanitation (Foster V, et al., 2010).

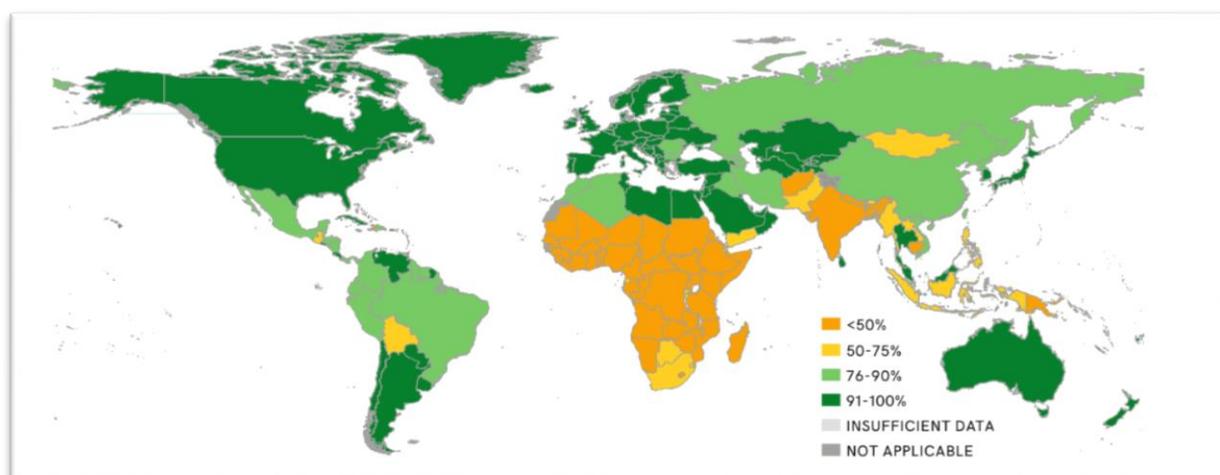


Figure 2 -Proportion of the population using at least basic services [Source (WHO and UNICEF, 2017)].

2.2. Sanitation Status in Uganda

Uganda National Sanitation guidelines defines sanitation as “the process whereby individuals and communities improve their quality of lives by safely disposing human excreta by any appropriate means, developing and maintaining safe water chains, attaining and maintaining personal, domestic and food hygiene, safely disposing of solid and liquid wastes and controlling vectors”(Ministry of Health, 1997). This implies that sanitation is broad and goes beyond the infrastructure provision. Improved sanitation in Uganda is estimated at 66 % with the urban population recording a higher coverage rate than rural, 7% of the population is connected to a sewer,11% to a septic tank , 48% having access to basic facilities while 5% practice open defecation (WHO and UNICEF, 2017). Latrine coverage in Uganda had been high between 1960s through to the early 1970s as shown in (Figure 3) below. Reasons cited for the high coverage were low population density, enforcement from public health act and respect of the local authorities(MOH, 2014). However, there was a decline in coverage (23%) due to the civil

strife recorded in late 1970-1980 and later an increase due to political stability and donor support in intervention programs(MOH, 2014).

Poor sanitation in Uganda is associated with an annual loss of 389 billion Ugandan Shillings. These costs are attributed to premature deaths especially among under 5 as a result of poor sanitation, productivity loss associated with seeking treatment due to diarrhoea and time poverty as a result of looking for open space for defecation (KCCA, 2016). This impact is high in urban centres such as Kampala due to high urbanization rate which puts pressure on existing sanitation infrastructure, limiting access to residents who end up using unimproved sanitation facilities increasing the exposure to sanitation related diseases.

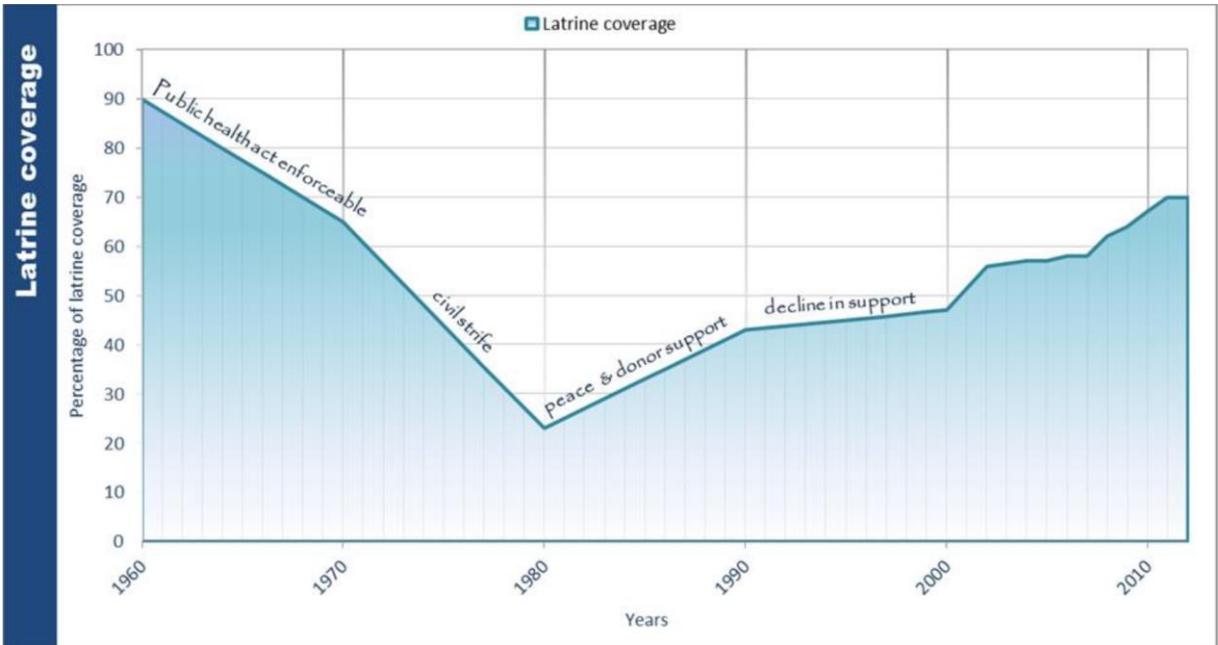


Figure 3- Latrine coverage in Uganda (1960-2010) [Source (MOH, 2014)]

2.3. Sanitation Status in Bushenyi- Ishaka municipal council

Bushenyi Ishaka municipal council is one of the constituencies in Bushenyi district where the population relies on onsite systems, with traditional pit latrines as the dominant type at 61% followed by ventilated pit latrines at 24%, followed by septic tanks and cesspools at 8%. Latrines (traditional and improved) and septic tanks are part of faecal sludge that is safely contained as demonstrated by the Excreta flow diagram (SFD) in (Figure 4) due to the practice of sealing full pit latrines and digging new ones(Nyakutsikwa, 2018). Public toilets are also available with a mix of septic tank, pit latrines, ventilated pit latrines and dry toilets. User fee for toilet use is between 200-500 UGX. There is high latrine coverage in the municipality with minimal concentration on the other components of the service chain due to manual emptying, limited cess pool trucks and lack of a treatment plant in the municipality (Nyakutsikwa, 2018).

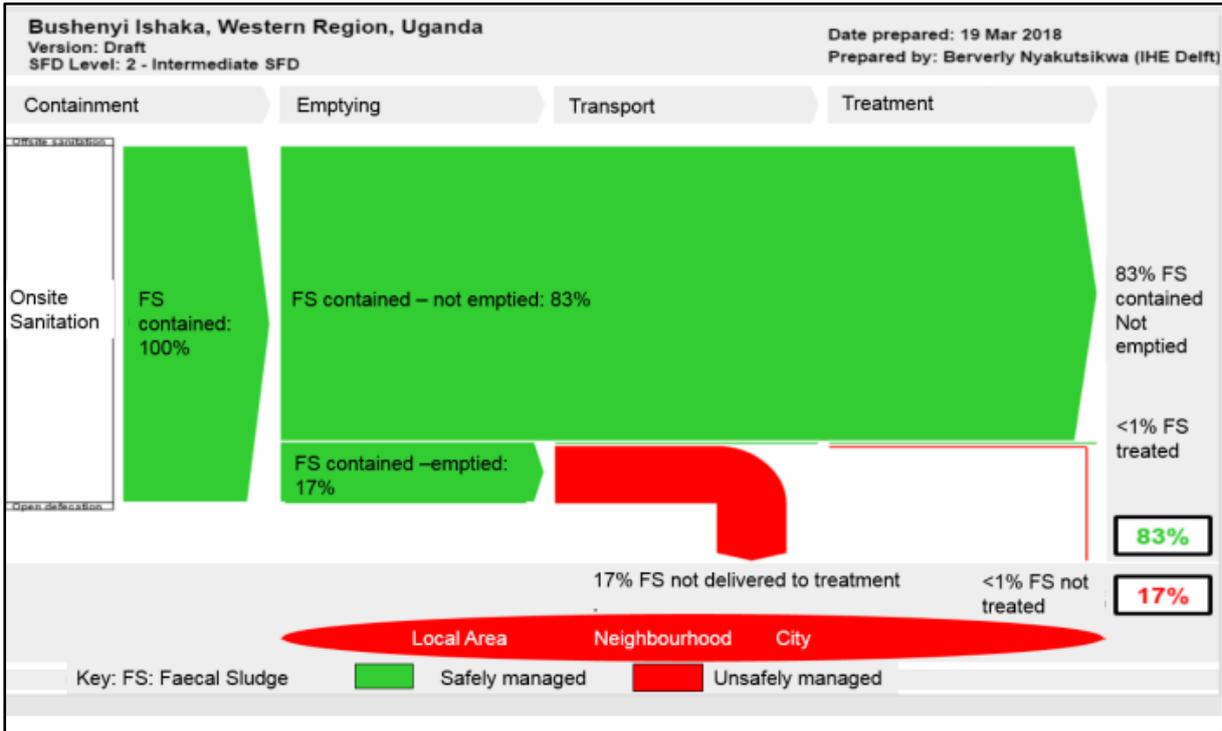


Figure 4 -SFD for Bushenyi-Ishaka municipal council [Source:(Nyakutsikwa, 2018)]

2.4. Incremental Sanitation

This is a narrative that relates the level of water supply with progress in sanitation infrastructure. In other words, the presence of a public stand pipe would translate into having an improved ventilated pit latrine and a pour flush toilet due to the amount of water needed for the functionality of the two technologies and also the amount of sullage² produced. According to this narrative, the progress is done incrementally within a time period depending on the type of water connection and financial ability. The narrative is also technologically prescribed however it does not advocate for the installation or connection to a conventional sewerage due to the financial costs and amount of water needed.

The whole idea behind incremental sanitation is selection of ‘base line’ technologies which can be upgraded in a planned sequence of improvements to a sophisticated ‘final’ solution (Kalbermatten 1982). However, the baseline technologies advocated for, can serve as the only solution that is viable depending on financial ability of an individual. Who is to determine what a sophisticated solution is and what qualifies as sophisticated?

2.5. Sanitation Ladders

The sanitation ladder concept has its roots in rural participatory methodologies used in the 1980s to aid in discussions and decision making among communities on the appropriate sanitation solutions (Potter, et al., 2011). They “*are a metaphor for the idea of incremental progression between service levels of different quality, starting at the bottom rung and climbing to the top*” (Moriarty, et al., 2018). The sanitation ladder used then not only considered the best technological options but also considered cost, convenience, privacy availability of local materials among other factors and this facilitated the communities to decide on the best option. The visual ladder was effective in selecting options due to the use of community initiatives as management models.

Technology oriented sanitation ladder

The technology oriented sanitation ladder is common across many countries due to the ease in reporting. The Millennium Development Goals (MDGs) sanitation ladder was broadly categorized as improved (facilities that separate excreta from human contact), unimproved (facilities that do not ensure hygienic separation of human excreta from human contact or public latrines or shared facilities with more two households) and open defecation (often regarded to as a public health hazard) (WHO, et al., 2008).

The MGDs ladder mainly focussed on the containment of excreta and only reported the proportion of the population who have access to improved facilities (Satterthwaite, 2016). The proportion of the population who moved from open defecation to unimproved were considered not to have ‘progressed’ up the ladder (Zimmerman, et al., 2015). The MDG ladder limits innovation as only predetermined types of sanitation options are included in each of the rungs

² Sullage is water generated from washing food, clothes and dishes. (Tiley E, Ulrich L, Luthi C, Reymond P, Zurbrugg C (2014) Compendium of Sanitation Systems and Technologies Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dubendorf, Switzerland)

and therefore communities have to go by what has been predetermined as improved or unimproved³ (Kvarnström, et al., 2011).

In recent years, the Sustainable development goals (SDGs) ladder was revised to include two extra rungs with the aim of attaining the SDGs as shown in (Figure 5). Safely managed includes improved facilities that are not shared with other households and excreta is safely treated onsite or offsite (Naughton, et al., 2017). Improved facilities⁴ have been classified under basic and include improved facilities that are not shared with other households. Limited facilities include improved facilities shared between two or more households.(WHO and UNICEF, 2017) Despite the inclusion of the safely managed rung, the ladder is still limiting as households in the basic category may be sharing facilities and disposing excreta on-site but do not qualify to be in the safely managed rung because of the sharing element.

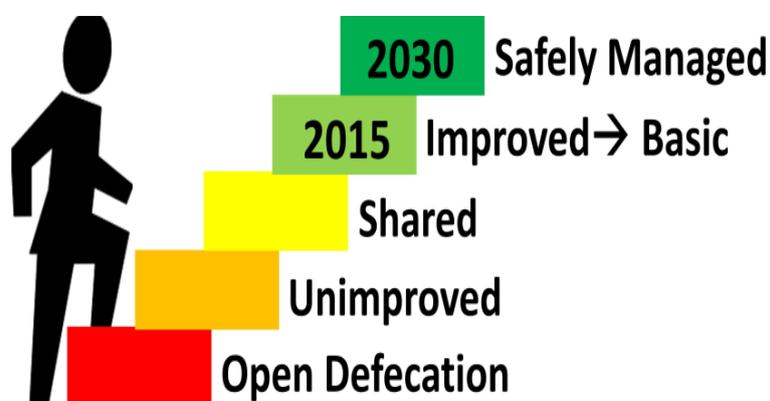


Figure 5 -SDG Sanitation ladder [Source (Naughton and Mihelcic, 2017)]

Function-based sanitation ladder

Critics of the technology based ladder recommended and suggested a seven step functional ladder broadly divided into health and environmental functions (Kvarnström, et al., 2011). The functional ladder encourages safe management of the different sanitation flow streams and aims to close the nutrient loop by enhancing nutrient reuse(Kvarnström, et al., 2011). The ladder does not prescribe any type of technology as it gives leeway for countries to choose the technology that suits the function, however, it still has an element of ascension attached with a higher cost and health benefit.(Kvarnström, et al., 2011).

³ Improved facilities are designed to hygienically separate excreta from human contact and include flush/pour connected to piped sewer, septic or pit latrines, ventilated improved pit latrines, composting toilet or pit latrines with slabs. Unimproved are pit latrines without a slab or platform, hanging latrines or bucket latrines WHO, UNICEF (2017) Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines Grojec A Geneva, Switzerland

Both technology and functional ladders have expounded on the importance of ascending the ladder. They however, have not suggested directives of how households can access financial assistance especially for the families that have other competing priorities. Some households might modify a part of their unimproved latrine to reduce contact with excreta or install handle bars for the elderly to use the latrines comfortably but still this does not count as ‘progression’ up the ladder (Foster V and Briceno, 2010).

2.6. Importance of Small towns

Small towns are slowly gaining recognition due to the critical role they play in accommodating the growing urban population which is projected to be 6.3 million by 2050(UNDESA, 2010). Most of the population growth will be concentrated in towns and cities of less developing countries with Asia, Africa and Latin America and Caribbean set to see an urban population increase of 1.7 billion, 0.8 billion and 0.2 billion respectively (UNDESA, 2010). In 2009, small towns with less than 100,000 inhabitants accounted for about one third of the urban population (UNDESA, 2010).An indication that small towns will bear the pressure of urbanization and hence suffer from a backlog of sanitation infrastructure (Reymond, et al., 2016).According to UNICEF, there is limited current and accurate data on sanitation for evidence based decision making in most small towns (Luthi, et al., 2017, Thomas and Alvestegui, 2015).

Small towns may be associated with delayed or unattained targets due to unavailability of development indicators to track progress as towns are characterized as either urban or rural(Adank, 2013). With the focus on Sustainable Development Goal 6(SDGs) ambitious target of ensuring equitable access to safely managed water and adequate sanitation for all and end open defecation, the JMP estimates that 1.7 billion people with safely managed sanitation were urban dwellers and 1.2 billion people with safely managed sanitation were rural dwellers(WHO and UNICEF, 2017). Small towns are not captured within such statistical assessment leaving out a large proportion of the population living in the rural urban continuum (Satterthwaite, 2016).

Sanitation funding and expertise in small towns had previously been neglected due to the focus of projects in large cities and the rural poor. Their uniqueness of having both rural and urban characteristics increases the uncertainty of implementation approaches (Caplan, et al., 2010). Sanitation in small towns is complex due to the involvement of multiple stakeholders along the sanitation service chain unlike water where the involvement is mostly with a utility company(Caplan and Harvey, 2010). There are current efforts in Malawi and Nepal in validating a sanitation toolbox used for sanitation planning with an aim of generating current and reliable data which will be useful in determining realistic and feasible sanitation solutions in small towns(Luthi, et al., 2017). There is some considerable effort that has gone into the small town water sector as evidenced by many International non-Governmental Organizations (INGOs) organizing conferences and stakeholder workshops to discuss water service provision in small towns (Adank, 2013). Academia have also showed interest by conducting studies and publishing peer reviewed literature on water financing options and management models in small towns(Humphreys, et al., 2018, Tutusaus, et al., 2018) On the contrary sanitation in small

towns has not received that much attention despite the introduction of piped water supply which should provide an opportunity for the development of sustainable sanitation business models and revamping or upgrading existing technologies (Thomas and Alvestegui, 2015). In addition, no studies have been done to understand how sanitation infrastructure has transformed through the years so as to have a better understanding of the practices on the ground.

2.7. Characteristics of Small towns

There is no clear definition of a small town due to the definition being context specific and different countries apply different criteria to categorise them (Caplan and Harvey, 2010).

Most widely used definition is one suggested by (Roche, 2000) , “ *Small towns are settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped systems, 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.*” This definition however does not cover sanitation maybe due to the multiple-actors involved unlike water where the management process is easier due to the involvement of a utility company in service provision (Caplan and Harvey, 2010).

Most small towns have both rural and urban characteristics. Rural characteristics are associated with agricultural productivity, subsistence farming, small and medium businesses whereas urban characteristics are as a result of light industries and service provision for the people in the surrounding area (Caplan and Harvey, 2010). The urban area is prone to migrants from rural areas due to labour demand for the light industries and small scale trading. In addition, the linkage of small towns with the surrounding rural areas promotes economic centres resulting in service provision in neighbouring areas (Caplan and Harvey, 2010, Thomas and Alvestegui, 2015).

In low- income countries small town settlements are constantly evolving and are mostly characterised by a core trading centre along a major road and scattered settlements around the commercial zone. (Caplan and Harvey, 2010). Households located at the periphery are reasonably spread away from each other, compared to the core and they tend to exhibit rural characteristics as elaborated in (Figure 6) below. The growth in small towns is dependent on varied functions which are mostly as a result of economic and social habits of the inhabitant for example, a commercial function or due to a transport route or market. In practice, towns are as a result of two or more functions not forgetting the residential function which is demonstrated as either dispersed (settlements found on the outskirts) , linear(trade centre located along the main and feeder roads) and nucleated(dense commercial centre located on a market or road junctions). This explains the dynamic nature of small towns where the functioning changes with time. (Nyakutsikwa, 2018)

Small towns are often referred to as towns in the rural-urban continuum. The mix of rural and urban characteristics increase the complexities associated with development of sanitation infrastructure in small towns. The development follows an unclear path due to the various approaches that need to be considered as neither the ‘top- down’ nor ‘bottom up’ are effective because the two approaches serve relatively small proportions of the population leaving a larger population in the ‘grey area’ (Hopkins, et al., 2003).

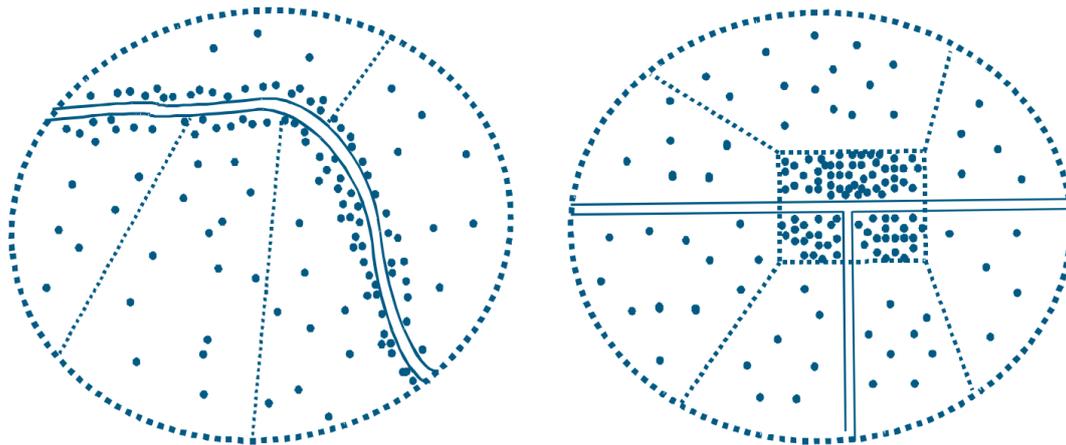


Figure 6- linear and nucleated type of settlements [Source (Hopkins, et al., 2003)]

2.8. What is Infrastructure?

Infrastructure can be broadly defined as artefacts, systems and processes needed for the functioning of a community or society. In the world of today, infrastructure has been looked beyond materiality as it combines technical and social system and can generate social effects through planned or non -planned activities (Harvey, et al., 2017). Looking beyond the materiality, infrastructure can be inclusive of services, interactions, institutions and standards, organizations and knowledge as well as economic and legal conditions (Koottatep, et al., 2019)

Infrastructure generally has been referred to as a technological apparatus managed by urban planners, government officers, non-Governmental organizations (NGO) and engineers. Such a view is limiting and creates misconceptions on the nature of infrastructure and consequently results in inadequate recognition of political, cultural and socioeconomic assumptions built into it, together with the daily effects of malfunction or their unavailability in everyday lives (Hutton and Chase, 2016). Sanitation infrastructure or lack thereof shapes the way people relate to each other by developing routines and schedules (Rodgers, et al., 2012). The routine development normally affects women who have to control the urge to relieve themselves and do so very early in the morning or after subsiding of long queues when accessing limited public latrines (Kulkarni, et al., 2017).

Infrastructure development is uncertain due to the potential of the new infrastructure changing or eliminating existing livelihood. Using Jakarta as a case study, Kooy, et al. (2008) show how infrastructure was used for the configuration of the identities of some neighbourhoods and communities (Kooy & Bakker, 2008; McFarlane &Rutherford, 2008). Development progress

in sanitation is achieved and ascertained when communities ascend a sanitation ladder with prescribed technologies (Kvarnström, et al., 2011). The ladder portrays the ascension as a linear process this however, does not take into consideration how infrastructure has to be built and reclaimed. The process of building and reclaiming is dependent on economic, social and political factors which end up complicating the progress. Furthermore, power relations are reflected and reinforced through everyday management of public water infrastructure and through the absence of infrastructure, some communities can be marginalized due to relationships of power based on race, religion, and class (Anand, 2012)

Infrastructure is contingent as it brings about changes that no one can foresee. As seen in Cape Town, the provision of unenclosed toilets sparked protests among the community. The Municipality argued that it had fulfilled its role of providing sanitation infrastructure while the community not only felt their dignity, safety and privacy would be compromised but also felt the provided facilities reminded them of apartheid era which was dominated by racial segregation (McFarlane, et al., 2017). In addition, infrastructure is seen not as a complete product or artefact but rather as a product liable to manipulation and improvisation when need arises. Such details are not captured by the sanitation ladder, as it only captures the proportion of the population reported who have access to a specific technology and the percentage who have 'moved' up the ladder regardless of the whether individual rights have been infringed on (Galvin, 2015).

Infrastructure is contextual and its performance depends not only on the technology but also on norms, economics, politics and environment. Sanitation infrastructure development is also contextual implying that developmental progress in sanitation should be contextual and intuitive to other cultures. The sanitation ladder encourages use of improved facilities that are not shared as the gold standard due to their positioning at the top of the ladder. This however, does not consider cultures where several families live in an enclosed compound and share an improved facility with in-situ disposal of faecal sludge.

Infrastructure has been used to build and maintain political relationships (McFarlane, et al., 2008, Obertreis, et al., 2016) and in the process some communities have been victims of politicization of infrastructure. In Mumbai, a neighbourhood affiliated with the ruling party had better sanitation in comparison to a neighbourhood which had to make do with make shift toilets which were precarious and swept away during extreme wet season forcing the residents to practice open defecation (McFarlane, et al., 2014).

2.9. What is Sanitation Infrastructure?

Building on the broad definition of infrastructure and (WHO, 2018) , sanitation infrastructure can be adapted to be systems that manage human excreta and black water through the sanitation service chain as shown in (Figure 7). Sanitation service chain has been identified as a series of steps involved in sanitation infrastructure provision and it mainly comprises of excreta disposal and collection from the either the dry or wet systems, conveyance and treatment until final disposal or reuse (Koottatep, et al., 2019).

Sanitation infrastructure has also been referred by (Koottatep, et al., 2019 p,143) as a *“combination of hard and soft assets of sociotechnical system used to provide sanitation solutions at public and private levels such as sewers, septic tanks, latrines/toilets, treatment plants, and disposal trucks which must take into account all the technical aspects of the solution and all economic, social, organizational, institutional and environmental aspects.”*

Sanitation systems can be broadly categorized as sewerage or non sewerage systems. Sewerage systems also known as offsite systems are mainly waterborne and include conventional and simplified sewer systems. Conventional systems often rely on gravity to transport large volumes of black water through a network of pipes to a centralized treatment plant for treatment with an aim of reducing environment degradation during discharge(Cairns-Smith, et al., 2014, Reymond, et al., 2016). Simplified sewer has its origin in Brazil and uses small diameter pipes laid at a flatter gradient within property boundaries (Tiley, et al., 2014).

Non –sewerage system also known as on-site systems provide an opportunity for the management of excreta or black water near the point of generation (Reymond, et al., 2016). On-site systems can broadly be categorized as septic tanks and pit latrines which require safe desludging due to accumulation of faecal sludge or septage .On-site systems were predominantly used in cities in the global North before the introduction of the waterborne system in mid-19th century. Currently, septic tanks remain a sanitation solution for peri-urban and rural areas in Japan, Europe and North America (Cairns-Smith, et al., 2014). Majority of countries in the global South rely on on-site systems as predominant sanitation systems in urban, rural and small towns as they account for between 60-100% coverage (Strauss, et al., 2000).

Due to decreasing phosphorus reservoirs and increased fertilizer demand, ecological sanitation (Ecosan) as an approach has been implemented with an aim of closing the nutrient loop. Composting toilets, Urine diversion dry toilets are among the technologies under the Ecosan(Cairns-Smith, et al., 2014)

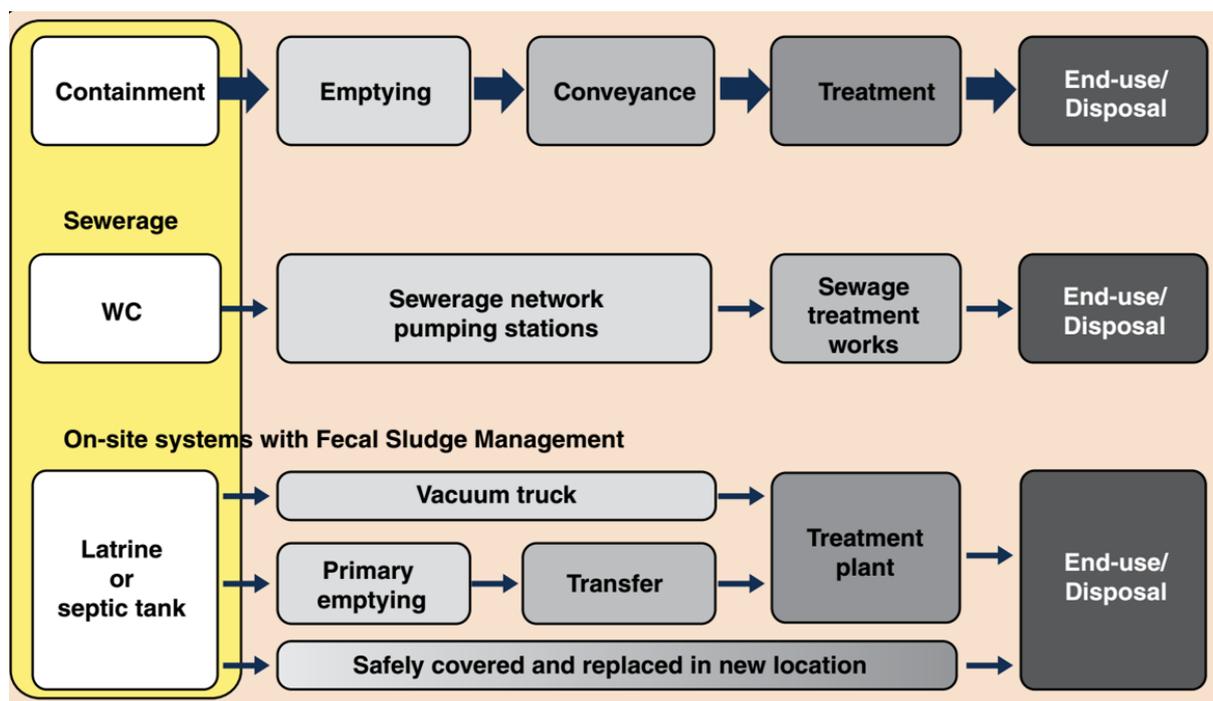


Figure 7- The sanitation service chain [Source : (Blackett, et al., 2016)]

In this study, sanitation will include menstrual hygiene management for two reasons. Firstly, the user interface or toilets provide a physical point of interaction with menstrual hygiene management as it provides access for changing menstrual absorption materials (Sommer, et al., 2013). Secondly, the type of absorption material used affects either the containment or conveyance systems especially pit latrines and sewerage systems where the absorption materials are responsible for reduced design life and blockage of the system respectively (Kjellen, et al., 2012).

This study therefore analysed the transformation of infrastructure across the sanitation service chain at the household level. This was done to understand the actions that the households have taken and continue to take to ensure they have sanitation infrastructure as households are expected to not only provide their own sanitation facilities but also ensure that they take appropriate action to empty the faecal sludge and or septage (Ministry of Health, 1997). School sanitation infrastructure was looked into so as to understand who is responsible for sanitation infrastructure change and also learn about current sanitation practices.

2.10. How Literature Review Ties with the Study

The study complicated the concept of the sanitation ladder and other mainstream ways of prescribing or dictating progress without necessarily understanding people's culture, financial capacities, environment and the actions individuals take to ensure that they have sanitation infrastructure. This was done by looking at how sanitation infrastructure has transformed over the years from the household level, understanding the decisions taken by the individuals and the drivers responsible for infrastructural change both at home and in schools.

The study drew on the lens of infrastructure as a terrain of social and political change to question the sanitation ladder narrative in a case study of small towns where there is limited information on sanitation infrastructure development and also because small towns are likely to bear the brunt of urbanization hence the need to understand what happens on the ground as this will contribute towards accurate and current data that will be useful in designing contextualized solutions rather than using a one size fits all approach.

Chapter 3

Methodology

In this chapter, I present the research design adopted and data collection methods and techniques used to facilitate in the attainment of objectives presented in Chapter 1. Data management and analysis are also presented.

3.1. Research Approach

The study was categorised under flexible design due to the fluidity that came with the research as the variables could easily be adapted depending with the situation on the ground. Under the flexible design, I used a qualitative approach so as to understand how sanitation infrastructure has transformed in Bushenyi-Ishaka municipality. Secondary data from a household survey conducted under the SMALL project was used in identification of informants who had stayed for long in the municipality.

Due to the nature of the research questions which try to understand how sanitation infrastructure has changed with time, I adapted a case study approach due to the need of reconstructing the sanitation infrastructure over time instead of frequencies (Yin, 1994). Another justification for the adoption of a case study approach is due to the in-depth analysis of the sanitation infrastructure development in its real context (Yin, et al., 2018). For this case study, a small town in Uganda called Bushenyi-Ishaka was chosen to understand how sanitation infrastructure has transformed with time mainly because small town towns are likely to bear the brunt of urbanization and it will be critical to understand the process so that evidence based policies can be formulated. The study is also building on previous thesis (Nyakutsikwa, 2018), from which I was able to identify a gap that formed the basis of my study.

Another reason for the specific location was due to an ongoing SMALL⁵ project currently implemented in Mozambique, Luweero and greater Bushenyi in Uganda. In tandem with this study, there were other two MSc research studies carried out in the municipal council.

3.2. Research Methods

Research methods are techniques for data collection and can be categorized in two approaches primary and secondary data collection. Primary data involves collecting data directly from the community through either surveys, interviews, participant observation or focus group discussions (Bryman, 2012). Secondary data involves collecting data from previously conducted household surveys, census, records, and books. This research applied both primary and

⁵ SMALL project contributes to developing models that assist governments and service providers in expanding and improving water and sanitation services in small towns- Integrated Research for Development- UN-IHE

secondary methods as presented in (Figure 8) with each data collection technique described below.

3.2.1. Oral History Interviews

These are interviews focussed on a historic account and mostly depend on an oral record of experiences at an individual level. Due to its nature of recounting historic events, the technique is prone to memory lapses and distortion (Bryman, 2012).

For this study, sanitation oral histories were used to explore how sanitation infrastructure has transformed over time. This was among the primary methods of research collection and depended on the rapport building with the informants especially due to the sensitivity of sanitation related questions to encourage openness.

Eligible informants from the community were chosen using a criteria that is summarized in (Figure 11). Due to the nature of the research requiring a lot of information, some community members were interviewed more than once as they were more conversant with the topic, also were very friendly and welcoming. The average age for the community members interviewed was 60 years and they therefore required patience and understanding while interviewing them. In total 19 community members comprising of 11 women and 8 men were interviewed.

3.2.2. Semi-Structured Interviews

These are interviews conducted with flexibility because the order of the questions may not be followed strictly (Denscombe, 2010). The interviewer may build up on the responses of the interviewee so as to get comprehensive information. For this study, semi-structured interviews were conducted with two primary head teachers, one retired head teacher, municipal council planner and municipal health inspector. Interview with the head teachers was done so as to understand the process of sanitation infrastructure development and who influences the development. The interviews with the municipality officials were done so as to understand the various by-laws that are governing the municipality, how sanitation infrastructure has changed in the municipality and if there have been any initiatives to improve the sanitation in the municipality.

3.2.3. Unstructured Observations

These are observations done without an ordered checklist but rather done in a more natural open-ended way. In this study, sanitation infrastructure and current practices were observed. For the sanitation infrastructure, instances of innovations were observed, recently sealed pits and also reuse of faecal sludge from the recently sealed pit.

3.2.4 Secondary Sources

Different laws, regulations and rules were reviewed so as to understand the drivers of sanitation infrastructural change. Previous theses that were done in Bushenyi-Ishaka municipality were reviewed for references and also to avoid repetition of work done. SMALL reports were also looked into to get a better understanding of what the project does. Grey and peer reviewed literature that deal with sanitation in small towns were also reviewed.

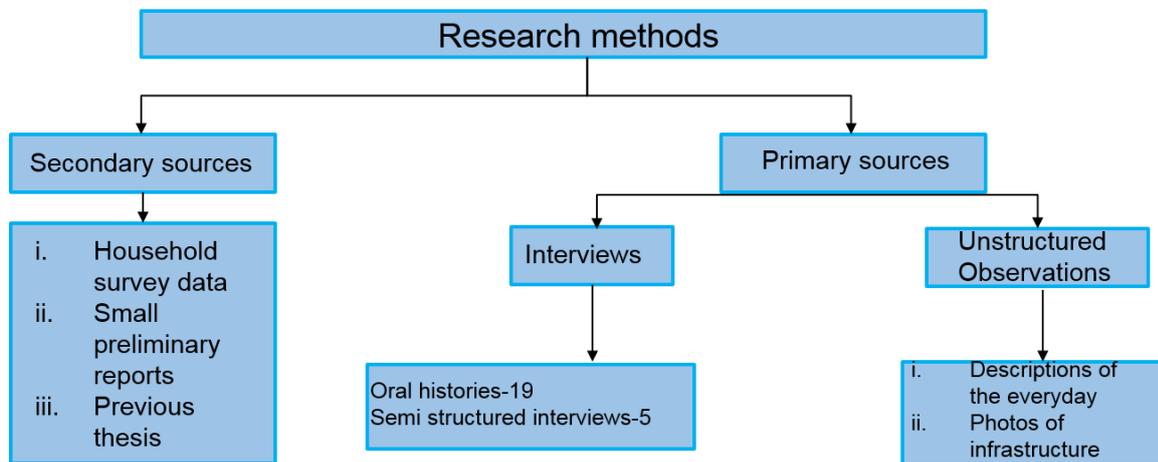


Figure 8- Data sources

3.3. Sampling Strategy

The study utilized purposive sampling based on a household survey that had been done in early 2018. Purposive sampling involves identification of individuals who are conversant with the area of study (Bryman, 2012). For the purpose of this study, individuals who have stayed for many years in the municipality were identified. Selection of respondents was done in two stages. First, mapping of the existing configurations was done so as to get the distribution of the existing infrastructure as shown in (Figure 9 and 10). After identification of the existing infrastructure, an inclusion criteria was identified, for those with flush toilets, the inclusion criteria was having lived in the municipality for > 20 years(the number of years for those with flush toilets was reduced due to the few configurations of the flush toilets.) As a result of the screening, 6 were eligible and 3 community members were identified and interviewed. For the pit latrines which were the most, the inclusion criteria was having resided for > 60 years in the municipality. Consequently, 79 were eligible and random sampling was then applied and as a result 15 informants were identified and interviewed. Selection criteria is summarized in (Figure 11) below. One elderly woman from the community was purposefully chosen from a different sample size (one of the MSc research studies), the elderly woman was selected based on the number of years she had stayed in the municipality and availability. The aim of having a common household in the two studies is to create a layer of information from the areas project SMALL is working in the municipality.

For the semi-structured interviews, snow ball was used to access the head teachers through referrals from other contacts.



Figure 9 -Mapped pit latrines in the study area [Source: Google Earth, 2018]



Figure 10 -Mapped flush latrines in the study area [Source: Google Earth, 2018]

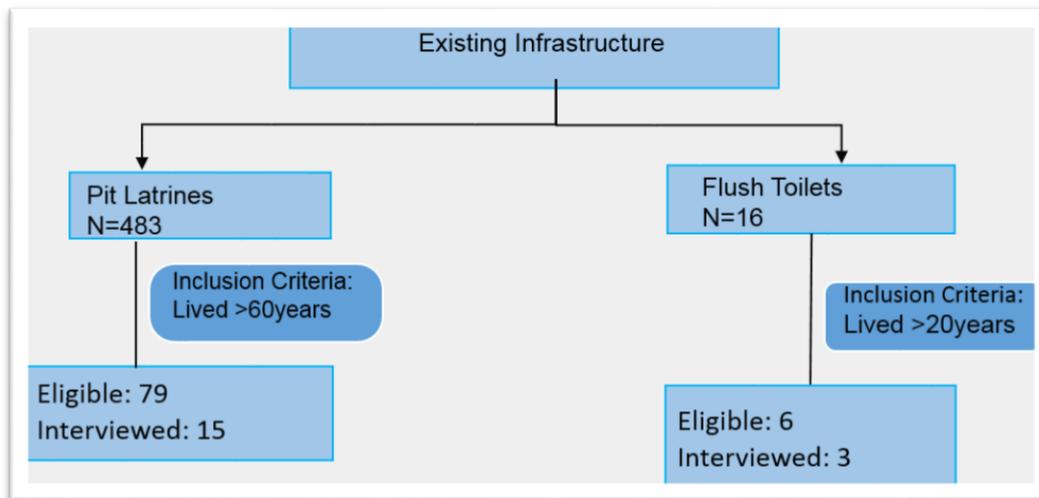


Figure 11- Selection criteria for informants

3.4. Data Management and analysis

The aim of the research was to systematically reconstruct sanitation infrastructure through personal oral histories. The interviews were translated, transcribed and stored in Ms Word. First step in analysis was identifying how to present my data. This was done by considering chronological presentation of the information so as to be able to capture any significant change that the community members made. There after thematic coding was done so that similar themes could be included in each of the time period.

3.5. Research ethics

Ethical considerations are the foundation of good research and should be maintained in different stages of a study (Medland, 2014). The household survey that was done had received ethical clearances from Makerere research and ethics committee and Eawag (Swiss Federal Institute of Aquatic Science and Technology). This study considered informed consent, confidentiality and anonymity.

3.5.1. Informed consent and the right to withdraw

Consent was sought from the community members upon being briefed on what the study entailed for them to make informed decisions. I emphasized on voluntary participation and the right to withdraw at any time. I also sought consent for recording and emphasized on the voluntariness associated with the recording, since the interviews were in the local language Runyankore and they needed to be translated. There are those who declined to be recorded and still participated in the interviews. Consent of taking photographs was also be sought as this helped in building trust with the participants.

3.5.2. Anonymity and confidentiality

All participants were assured of their right to anonymity by explaining to them that no personal identifiers will be used during data analysis and also data confidentiality will be maintained as the researcher and the transcriber were the only ones with access to the data. The names of men and women were changed during analysis and presentation of findings to maintain anonymity.

Chapter 4

Memories of Sanitation

4.1. Omugabe Regime (1940-1950)

Throughout this period of time, Bushenyi's status as a municipal council had not yet been promulgated and both Bushenyi and Ishaka were rural settlements, with Bushenyi having a business elite composed of Indian migrants whereas Ishaka was more of a rural settlement without much diversity in economic activity. There were very few buildings and shops in either of the settlements and the only place which had diverse economic activity was Mbarara located 60 km from Bushenyi and hence majority of the people used to walk from Bushenyi to Mbarara to look for some commodities such as salt and soap. During this time, Uganda was under the British protectorate government while the Western region where Bushenyi lies was under the British rule and also had traditional rulers.

4.1.1. Materiality of the houses.

The houses during this time were simple huts made from locally available materials. Most of the huts were raised so as to provide shelter for the animals as stated by Bweju, 75 year old community member. *"We had temporary huts and we could even share the hut with animals"*. However, living with animals increased the incidence of zoonotic diseases as the animals could transmit diseases and also become hosts to flies. To alleviate the prevalence of the zoonotic diseases, there were mass vaccinations of the animals.

Communal living was predominant during those days as families would live in communal villages and carry out activities together. This type of living, as recalled by some of the oldest members of the community, fostered unity and was useful when performing construction works as everyone would give a hand when required as explained by 76 year old Martino, one of the community members. *"People used to live in communal villages and used to share necessities together and celebrate each other"*. Due to the communal villages, settlement patterns were dispersed and this led to increased availability of land for coffee and tea farming which was one of the main economic activities in addition to cattle rearing and brewing of local brews such as 'tonto' and 'waragi'.

4.1.2. Memories of Sanitation

Sanitation then was a matter of convenience as majority of the people used to ease themselves using ways that were suitable to them. Open defecation was one of the methods where people would go individually to the plantations whenever they felt the urge. This was mainly due to inadequate facilities, availability of land due to dispersed settlements and no formal laws or rules on sanitation. It applied to all members of the family even visitors as recalled by Isaac, a 96 old man from the community *“People used bushes and plantations as toilets and it was worse when one had a party or a function people could use the whole place and make it dirty.”*

One of the things people remember was the “cat method”. This entailed the use of hoes to dig holes which were used as toilets. Abbo, an 80 year old elderly woman recalled what they used to do.

“We used to dig small holes in the bush or plantation and after that we cover with soil”.

4.1.3. Sources of Water

Water connections had not been introduced and this therefore forced people to use alternative water sources. The most used sources were the communal water sources where surface water was the major source of water with springs and wells being the most dominant. Wells were mainly dug by community members and they also shared a role in the clean-up organized by the village heads. Community members argue that the water then was very clean and they could consume without any treatment. The reason for the perceived cleanliness was because they used to clean the wells regularly and a maximum of 10 families would use one well thereby reducing chances of surface contamination. Adroa, an elderly man who has lived 80 years in the study area remarked *“All community members would be notified when to clean the well or spring and they come and do it.”*

4.2. Implementation of the Public Health Rules (1960-1970)

Uganda gained its independence from the British rule in 1962. The kingdom government was still in place, it was however abolished by the president in 1967. Despite the abolishment of kingdoms, the appointed chiefs would still go in communities for enforcement as they were highly respected. The era was signified by economic hardship due to an ongoing civil conflict. Women, children and elderly would queue for food rationing which would finish before everyone had been served. Akiki, a community man who has lived in the municipality for 70 years explained:

“A lot of people were kidnapped and killed. We used to hide in bushes for fear of being taken away.”

The Public Health Act of 1935⁶ had been introduced and had been effective. The act however was specific on provision of drainage, sewers and water closets in buildings and it did not address sanitation in households. The Public Health Act of 1964 was formulated as a revision of the previous act this act was therefore the basis of sanitation with a focus on urban areas. The

⁶ The Public Health Act Chapter 281 sections 80-89

same act also formed the basis of formulation of Public Health rules⁷ related to sanitation formalized and everyone was expected to not only construct and use latrines which conformed to specific conditions but also have a granary and maintain a clean compound free from long grass. Open defecation was also prohibited in the rules and this therefore encouraged use of latrines.

It was during this period that the majority of those who were practicing open defecation were forced to not only construct pit latrines using locally available materials but also use them. Failure to which would result in a fine of not exceeding twenty shillings or a term of imprisonment not exceeding one week or both.

4.2.1. Introduction to new infrastructures.

During this period only a few high income people had iron roofed houses. These were people who were farmers or those who were working for the government. After independence, more development (change in the number and materiality of buildings) was observed as some people could travel to 'Buganda' to become labourers in cotton farms, others could sell goats or cows to get enough money to purchase iron sheets for roofing.

4.2.2. Materiality of the Latrines

Latrines⁸ built during this time were rudimentarily built and mostly lacked doors. Despite the condition of the latrines, they were used due to the rules that had prohibited defecating anywhere else other than a latrine. Most of the community members were obliging to the rules so as to avoid paying the fine and/or imprisonment. Most of the latrines were shallow pits around 8 feet deep with logs as slabs, mud and wattle superstructure and grass thatched. Natukunda, a woman who has lived 60 years in the community explained: *"Toilets were built with logs, mud and wattle, but people could fall in the pits because toilets were poorly made.* Once the latrine fills up, the superstructure was demolished and filled with soil to prevent accidents and another latrine was built. A banana tree would be planted on the filled pit to reuse the nutrients. The logs that had been used for building the latrine would be reused for cooking.

Tinkering with infrastructure was observed as majority of the community members looked for innovative ways to increase the durability of their latrines. Some smeared the floor of the latrine with rammed earth and swamp sand and this improved the cleaning routine and minimized accidents. Some seared the latrines with cow dung to prevent the walls from collapsing hence increasing the longevity of the latrines. Others changed the roofing of the latrine from grass to papyrus as it was regarded as creativity due to the longevity associated with the reeds. Doors were still not a common feature due to the associated costs that came with its installation, they however ensured privacy by using mats woven from swamp reeds to serve as doors.

⁷ Public Health(Rural Areas)(Health and Sanitation) Rules,1968

⁸ Latrines were built in the compound not nearer than 30 feet from a room constructed or adapted for use as a living room or sleeping room inclusive of a food preparation room

4.2.3. Cleaning and Cleansing Materials.

Soft leaves were the source of anal cleansing material. This was due to their availability. Women were tasked with looking for soft leaves and put them in the latrine for use. In some instances they would make baskets out of twigs so as to secure the leaves and prevent them from falling down.

Cleaning of the latrine was done on need basis especially if it becomes too dirty since majority of the latrines were made with logs. For the ones who had smeared the floor with earthen they would sweep it every fortnight. Ash and burning of dry banana leaves were used to reduce odour and kill flies.

4.2.4. Taboo Subject-Menstrual Hygiene Management

Menstruation was a strictly private affair which made it difficult to disclose to anyone. The women reported not to have been given a talk on menstruation and how to deal with it and they mostly heard it from others. Pieces of clothes were mostly used which would be washed and hanged in privacy as recalled by Nasiche, an elderly woman who has lived 64 years in the municipality. *“We would wash our items far away in hidden place as we had to hide our secret issues as there is no need to expose ourselves and we would be ashamed to see your blood.”*

4.2.5. Sources of water

In addition to surface water, rain water harvesting was taken up as a practice to supplement the existing water sources. They did this by collecting rain water in small containers such as basins and saucepans and those who were financially capable built water tanks for storage. As for the hand dug wells, they would still take care of them ensuring that everyone participates in cleaning and also restrict animals from accessing the wells.

Chapter 5

Contemporary Sanitation (1980-Present)

The civil armed conflict ended in 1986 in most parts of Uganda. The peace encouraged residents of Bushenyi to settle and put up permanent structures. The prevailing peace also encouraged community members to travel to different parts of the country for employment opportunities. This era also symbolized the elevation from a rural town council to a municipality.

5.1. From Town Council to Municipal Council

The change in status to a municipality involved an extension of the administrative boundaries to include more parishes which were termed as rural by then. The parishes were later classified as peri-urban areas. With the change of status came an improvement of basic services provision such as water, electricity, health centres and better sanitation infrastructure. It is worth mentioning that, for the community, the municipality status did not only come with advantages, but also with some disadvantage that included: abiding by the building standards regulations which required approval of building plans by the municipal engineers, prohibition of temporary structures within the core area of the municipality, and restrictions for planting trees, shrubs and crops within the municipality.

Also, the advantages associated with the elevation to the municipality status have not benefited everyone in the community. There are those who still do not have access to electricity and water. Reasons associated with this delay might be due to the demand driven approach that is currently existing.

Elevation to a municipality also resulted in autonomy to use their own generated revenues to run the affairs of municipality. Due to competing priorities, budget allotment for sanitation is done on need basis and mainly covers construction of latrines in public spaces such as the market.⁹ The municipality is also unable to provide adequate faecal sludge management due to limited management capacity and low revenues.

⁹ KIII, KII 2

5.1.1. Settlement Patterns in the new municipality

The municipality has linear and nucleated settlement patterns as most houses or buildings are located along the road with sparse population located in the peri-urban areas. Sparse settlement is not the only characteristic of the peri-urban areas, there is also a dominance of semi-permanent houses with sand finishing to enhance the aesthetic look. Family dynamics include several independent households within a compound where they share a latrine and in some cases a bathroom.

Urban areas on the contrary are characterized by permanent structures with more elaborate finishing and roofing as shown in (Figure12). Most houses in the urban areas have access to gates for security reinforcement, the key and lock mechanism is only evident in the houses. In peri-urban areas, there are no gates and footpaths have been created in people's compounds by community members as they go about their activities.



Figure 12-Types of housing

5.1.2. Sources of Water

The majority of residents in urban areas have access to water supply due to the availability of private and public connections from the National Water and Sewerage Company which serves 35.5 % of the population. Private connections are yard connections which are metered and charged according to one's water consumption whereas public connections are mainly public stand pipes (Psp) where community members are charged per container of water. Water prices vary with the type of water supply, those with private yard connections are charged 3516UGX (0.9 Euros) per cubic meter and those at the Psp are charged 50UGX (0.01 Euros) per container. Residents in peri-urban areas rely on alternative water sources such as wells and protected springs for their daily activities and this has an effect on how water is used due to the frequency of going to the protected springs and wells. Alternative sources especially wells also put the lives of those fetching water at risk by exposing them to drowning.



Figure 13 Water sources (clockwise) protected spring, yard connection, public stand pipes, and open well

5.2. Sanitation Infrastructure

Investing and changing sanitation infrastructure is a practice that has been taken up by everyone due to the Public Health rules¹⁰ that were initially formalized and enforced by traditional chiefs. Everyone has access to sanitation infrastructure although the type varies with location and financial ability.

In the early years of this era, unlined¹¹ grass thatched semi-permanent pit latrines were dominant. The depth of the pit latrines varied from 25- 50 feet deep depending on the topography of the area as sand and water table influence the depth of the latrine. Deep pit latrines are perceived to keep flies away for those who do not have a latrine cover.

With time, ‘second hand iron sheets’ were used for roofing the latrines so as to keep up with the new trends that were present in the municipality. Community members explained that some of the reasons for moving from grass thatch to iron sheet roofing were: the development and growth of the municipality, the availability of resources, the influence from neighbours, and the scarcity of grass and inconvenience of grass as it could get old very easily. Sacrifices were made so as to keep up with the growth and the new trends in the municipality as not everyone was financially able to put up the new improved structures. To acquire the new materials, some sold domestic animals (goats and pigs) to get some money, some also used bridal transactions¹² to procure building materials, and some sold the local brews in the markets to get some money, while others had to rely on relatives.

In the 1990s, the availability of new materials especially locally made bricks encouraged some to construct improved latrines while others only made latrine improvements. This however did not cut across the whole municipality as there were those whose financial situation would only allow them to put up semi-permanent pit latrines made from mud and wattle due to their affordability. It was also during this time that the government used to fund competitions celebrating the cleanest villages, with the “best villages” awarded prefabricated slabs and latrine covers made from cement. Natukunda, an 82 year old elderly woman recounts, “*We participated in a competition and our village won, all of us we were given a slab and a toilet cover by the government.*” The competitions were a motivating factor for community members to ensure that their villages remained clean.

¹⁰ Public Health(Rural Areas)(Health and Sanitation) Rules,1968

¹¹ Pit where the soil has not been plastered with brick, rot resistant timber, concrete, stones and mortar Tiley E, Ulrich L, Luthi C, Reymond P, Zurbrugg C (2014) Compendium of Sanitation Systems and Technologies Swiss Federal Institute of Aquatic Science and Technology(Eawag), Dubendorf, Switzerland .

¹² Bride price would include between ten to fifteen cows and some pots of beer paid to the bride’s family as a sign of commitment and seriousness of the bridegroom.

The introduction of water connections also encouraged the installation of cistern flush toilets for a selected few who could bear the cost of building them. However, the availability of water did not guarantee their consistent use due to the convenience associated with pit latrines as they reduce water use and prices as explained by Namono, a 69 year old female retired government official. *“Pit latrines are convenient as they minimize water related costs as each flush consumes 7 litres of water and someone cannot go during the day to urinate and use that much water.”*

Pit latrines are a necessity in every compound even for those who have flush toilets as they are used in emergency cases especially during the dry season and they are also used by visitors during social gatherings.

The type of infrastructure is different in different parts of the town. For those in the more urban areas¹³, the regulations¹⁴ limit the kind of infrastructure to construct, as core areas of the municipality are prohibited from having any temporary structures. Current guidelines are also encouraging installation of water borne systems connected to septic tanks despite lack of any treatment plant (waste water or faecal sludge treatment plant) within the municipality.

A conversation with members of the community revealed no latrine provision (nor subsidies) at the household level in the town, by either NGOs or government. Sanyu, an elderly man in his 80s who has been living in the municipality for long time, termed the provision of sanitation infrastructure as ‘mind your business.’ This therefore makes community members use local materials which are affordable and easily available.

While traditional unlined pit latrines are still the dominant sanitation infrastructure in use, due to the affordability in putting them up, the majority of the community have improved the infrastructure to provide safety and privacy. There has been inclusion of doors for those who can afford, some have made a ‘curtain wall’, some have provided a cover for the latrine. Some are still using mats made from reeds, piece of cloth and sacks to enhance privacy. They have also made a provision for lighting and ventilation in the latrine by having holes on the walls as shown in (Figure 13).

Sanitation infrastructure development in the municipality is uneven due to the ‘mind your business’ analogy where there is no state investment and the community can only embark on changes based on their own financial ability. This finding is corroborated by the national sanitation policy which mandates individuals to provide their own sanitation (Ministry of Health, 1997). For those in the urban areas, the laws and regulations are already dictating the pace of development due to the current bye laws. While for those in the peri-urban the pace of changes is dictated by financial ability and help from relatives.

¹³ Urban areas mainly areas with close proximity to basic services like electricity, water connection, school, health services

¹⁴ Bushenyi-Ishaka Town Council(Building Standards)Bye-Laws, 2014

To ensure proper functioning of infrastructure, the community members individually operate and maintain the latrines by adding more grass to the leaking roofs which at times pose as a health hazard as the heavy grass can lead to the collapse of the superstructure made from mud and wattle, some repair the rotten logs to ensure that everyone has access to the latrine without endangering their lives, some weed around the facility so that it can look “presentable” and some smear the latrine walls with sand to increase the longevity of the latrine and also increase the aesthetic look.

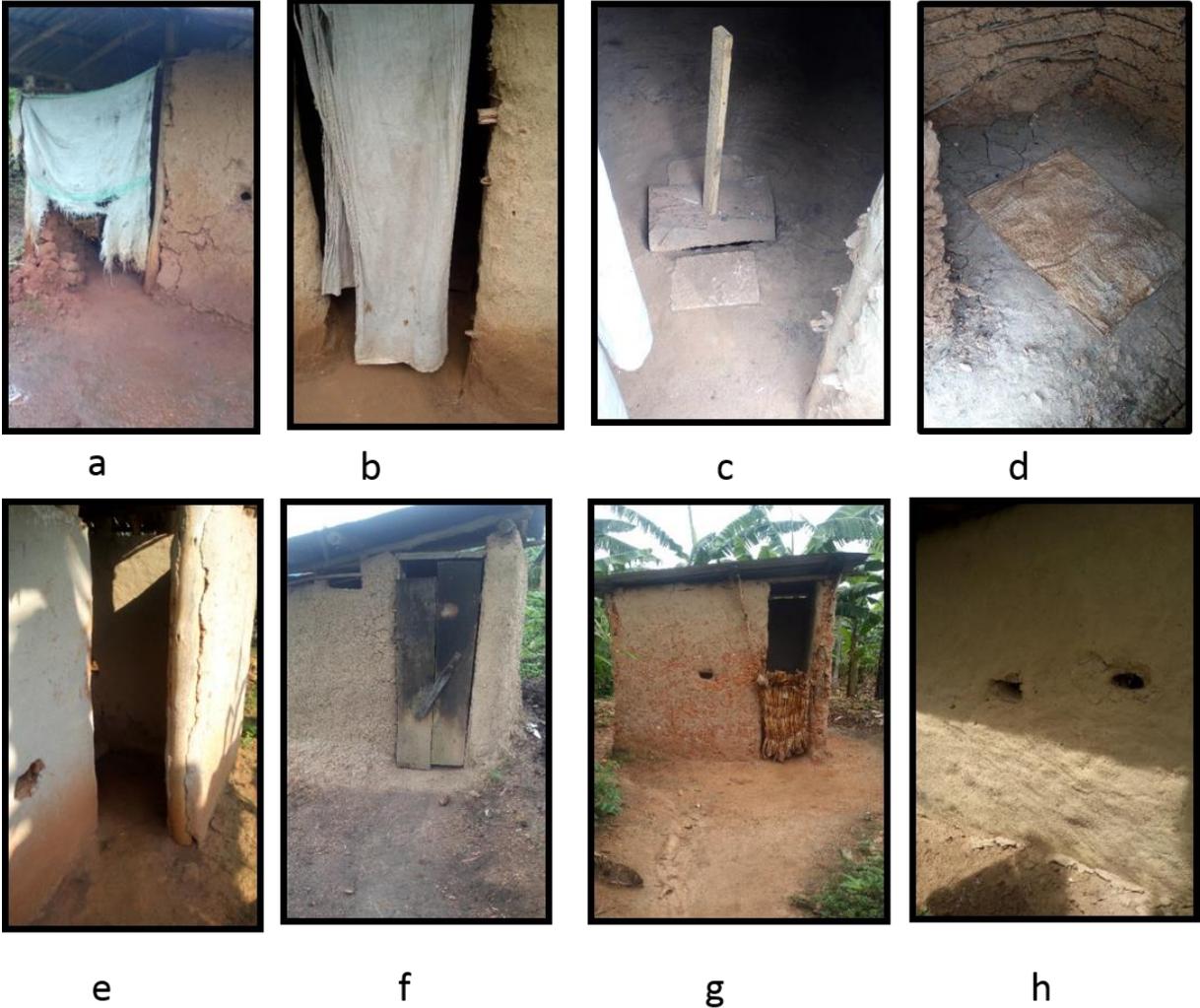


Figure 14- Infrastructure innovations a) sack to enhance privacy, b) long piece of cloth for privacy, c) latrine cover made from wood to keep away flies, d) sack that serves as a latrine cover, e) curtain wall for privacy, f) wooden door for privacy, g) woven mat that serves as a door, h) holes on the wall for ventilation and lighting

5.2.1. Cleaning and Cleansing Materials

The kinds of cleansing materials used were dependent on affordability and availability. While there are those who have been accustomed to use toilet paper since they can afford it, leaves and waste papers (exercise books and newspapers) are still used by majority of the community due to the reduced costs as stated by Yokubu, an 81 year old man from the community. *“We use leaves and when a visitor comes we sacrifice and buy toilet paper for them but the leaves are the cheapest.”*

Cleaning of the toilets was reportedly done by women based on the kind of toilet. Those with improved facilities such as flush toilets and improved latrines that have cemented slab clean the floors with water, and locally available detergents such as ‘vim’ and ‘jik’. Traditional latrines are swept weekly or on need basis by women in the household. Most community members burnt dried banana leaves to kill the maggots while some used millet chaff as it had some fragrance as mentioned by 80 year old Namazzi. *“For the smell, we used to get millet chaff and put it in the toilet to avoid the bad smell.”*

5.2.2. Emptying and Transport

Emptying and transport in the town are a challenge due to the limited number of vacuum trucks and lack of a treatment plant. The nearest treatment plant is located 60 kilometres away in Mbarara from where the vacuum trucks are requested which makes it expensive for community members to engage their services. This has therefore led community members to resort to taking up alternative practices such as hiring manual emptiers. This however applies to those who have improved facilities as defined by the SDG like the ventilated improved pit latrines, pit latrines with slab and cistern flush toilets connected to septic tanks. Due to the limited number of vacuum trucks to transport the sludge, the emptiers desludge the septic tanks and pit latrines and bury the sludge or septage in-situ without planting banana trees, as was done in the past. Due to the illegality of manual emptying, some manual emptiers sometimes wait for night fall to empty faecal sludge from the improved facilities and dump it in the nearby bodies of water as mentioned by Miremba a 63 year old woman, *“We empty using local people and dump it in swamps but we do it at night.”*

Those who use traditional unlined pit latrines, follow a more traditional method. Upon filling, the pit latrine is sealed and given a waiting period of 6 months before banana trees are planted. The sealing of the latrines is important as most community members are aware of the risks associated with an open pit as explained by Mukisa a 96 year old elderly man, *“we cover the pit because we prevent people from falling in it and control flies to come out and cause diseases.”* The practice of burying/sealing pit latrines is thus still in use as shown in (Figure 14) for those who have unlined latrines where emptying is a challenge.



Figure 15- recently sealed traditional pit latrine and reuse of nutrients by planting banana trees

5.2.3. Toilet Access

Despite close proximity to latrines due to them being located within the vicinity of the house, some of the elderly women are unable to go out at night and this therefore forces them to have a routine of going either before sleeping or having to hold until morning. Families also use containers for the children at night, as they are normally accompanied by an adult to the latrine.

Others have improvised the use of buckets which are emptied in the morning especially when one is sick with limited mobility and in areas with insecurity like in the urban areas where the presence of latrine doors does not necessarily entail enhanced privacy and security. Miremba, a 63 year old woman recalls the changes in insecurity. *“As the town developed many people are around so security is not all that good, so it is very insecure to move at night to go to the toilet.”*

5.2.4. Menstrual Hygiene Management

Approaches on menstrual hygiene management changed and mothers could now discuss and teach their daughters how to handle menstruation as elaborated by Abbo, an 80 year old woman. *“When my daughter came of age, I would train her how to go about it.”*

Nasiche, another 80 year old elderly woman in the community also revealed how the washed clothes would not be hung in privacy. *“We could tell them to use clothes as introduced and they could pad themselves and wash them, hang or dry them in the compound.”*

There was a change from using clothes, to cotton wool, and currently to menstrual pads which would require disposal upon being used. The cotton wool pieces were mostly bought despite, having cotton farms in the western region. This however applied to only those individuals

who could afford the changes as there are those who are still using clothes for menstrual management.

5.3. Sanitation in Schools

Two schools were visited one was a mixed day and boarding school, while the other was a day school. Both schools had enrolled male and female students. In one of the schools, the youngest students were in pre-school while in the other the youngest students were in primary school with an average of 5 years. The boarding school is located in the urban area a few meters from the main Bushenyi-Ishaka road while the day school is located in the peri-urban area. Both schools were founded by different churches which ran the development projects in the school. Currently both schools are government aided schools as they are given grants through the District Education Office.

Infrastructure development in schools is either dictated by government through the local government or by parents through school committees (parent's teachers association and school management committees)¹⁵. For those relying on government initiatives, an assessment is done during supportive supervision and the needs and urgency of the matter presented in the education office where relevant course of action is taken.¹⁶

Parents who are financially able to fund development projects, normally make an annual contribution (determined during general meetings) to improve school infrastructure.¹⁷ Some of the parents sometimes take up the initiative and contribute towards the infrastructure by contributing the raw materials especially bricks which are locally available¹⁸.

Sanitation infrastructure in schools has changed over the years to accommodate higher enrolment rates and also to comply with the 1 toilet for every 40 students national guidelines (UNICEF, n.d.). Gendered toilets was a common feature in the schools visited with considerable distance between male and female student latrines and it was said that this increases privacy especially when the girls are menstruating. The pre-schoolers have also been taken into consideration by having latrines which are age friendly (size of latrine hole is smaller as compared to the others) to encourage continuous use of the latrines. What is worth noting is the equality in choice of technology between the teachers and students as they both had ventilated improved latrines¹⁹.

An interesting observation was the inclusion of a toilet facility which had rail bars for students with disability. The toilet block was a government initiative and the head teacher remarked that at the moment the school did not have students with disability²⁰. Emptying in schools is a manual process that requires overnight preparation where chemicals are poured into the pit to

¹⁵ KII 3&KII4

¹⁶ KII3,KII4,KII5

¹⁷ KII 3

¹⁸ KII4

¹⁹ These are toilets with increased airflow due to the presence of a ventilation pipe Tiley E, Ulrich L, Luthi C, Reymond P, Zurbrugg C (2014) Compendium of Sanitation Systems and Technologies Swiss Federal Institute of Aquatic Science and Technology (Eawag), Dübendorf, Switzerland

²⁰ KII4

kill maggots and later the faecal sludge is manually removed and buried in situ²¹. A retired head teacher recalled not having seen any emptying done in the schools she had headed but remembered seeing maintenance with a local salt ‘*ekihonde*’ which is put in the latrine to help in volume reduction of the faecal sludge by turning the faeces into watery consistency increasing its absorption²². This local salt is also used in cooking.



Figure 16-On-site systems in Schools and the local salt ‘*ekihonde*’

5.3.1. Cleaning and Cleansing Material

School management has a system of ensuring that everyone is using tissue paper as cleansing material and this is done by ensuring that parents provide four tissue rolls during the schools’ opening day. This is done to accommodate those who cannot afford to purchase and also promote equality among the students. Cleaning is done by students under the guidance of teaching staff and this is done to teach responsibility among the students.

5.3.2. Menstrual Hygiene Management

Menstrual hygiene management was accorded varied levels of importance between the two schools visited. The boarding school had complied with the sanitation guidelines that dictate the provision an incinerator as shown in (Figure 16) for burning of menstrual pads. This was done after the emptiers complained that the pits were getting full quickly and more so the pads were making it difficult to empty the pits.

A conversation with Max, a head teacher in the day school showed how uncomfortable it can be to have a conversation around menstruation with an adult man. “In this school the students go back home and they go and change at home”, he declared. He also mentioned the use of pits for disposal after some probing. It is however interesting to note that both schools have a senior woman who is responsible for sensitizing the students on menstruation and also have extra underwear and pads in case of emergency cases.

²¹ KII3&KII4

²² KII5



Figure 17- Incinerator

5.4. Which Toilet Do I Aspire to Have?

While I thought that flush toilets would feature as everyone's desired toilet, as described by Morales, et al. (2014) in their study of Buenos Aires, this was not the case. Some community members proved me wrong as there are those who desired permanent latrines so that they do not have to demolish their latrine every time it fills up as mentioned by Nasiche, a 65 year old woman in the community, *"I cannot to refuse to have a good one like the one which is cemented and plastered with good doors and permanent."*

For some, they preferred the convenience that comes with a latrine due to 6-7 litres used for a flush as explained by 69 year old Nammo,

"Pit latrines are convenient as they minimize water related costs as each flush consumes 7 litres of water and someone cannot go during the day to urinate and use that much water."

Some were content with the latrines that they have as they were serving them accordingly and they occasionally apply sand on the superstructure them to make them look "smarter" and also help in cleaning as mentioned by Namazzi, an 80 year old woman, *I am content with the kind of toilet I have as there is no problem with it."*

For those who desire to have a flush toilet, the desire was mainly associated with breaking developed routine at night of going before sleeping or improvising buckets which were emptied in the morning as stated by 96 year old Isaac, *"I would like to have a deep flush toilet because we are old and we want an inside toilet to help us at night as it is not easy when we feel like going out at night."*

However, lack of financial support will result in their desires going unfulfilled and limit access to use of sanitation infrastructure.

CHAPTER 6

Why Did Infrastructure Change?

In this Chapter I present the drivers associated with sanitation infrastructural changes. The drivers represented are different for different parts of the municipality due to it having both urban and rural characteristics. The first infrastructural change that was observed was during the postcolonial period where the enforcement of public health rules ensured everyone excavated and used latrines failure to which result in a fine, imprisonment or both.

6.1. Urbanization and new trends

Modernity facilitated latrine infrastructural changes observed. Most people wanted to ‘look’ like their neighbours and hence started using second hand or left over iron sheets for latrine roofing. ‘Second hand iron sheets’ is a term given to given to iron sheets that have been reused having been previously used as roofing source in another building. *“I sold my goat and bought iron sheets but on buying iron sheets I had a program of building a house, the remains are the ones I put on the latrine.”*- explained Adroa, an 80 year old man.

While urbanization contributed immensely to the latrine infrastructural changes observed, scarcity of grass was also reported as a contributing factor towards infrastructural changes. Reasons associated with grass scarcity were high population growth and clearing of weeds for farming. Due to the nature of infrastructure being messy and requiring constant maintenance and care, sanitation infrastructure that was grass thatched would continuously be repaired by adding more grass and most often times resulting in an unstable building which could cave in putting the life of its users at risk.

6.2. Availability of Funds

Finances were at the centre of any development project as echoed by most of the community members who had changed their infrastructure. This finding is almost similar to a study in Malawi where access to flexible microfinance options was a motivating factor for change in sanitation infrastructure (Chunga, et al., 2017). Some found it easy to accommodate the changes because they received help from their children and they therefore did not incur any cost, some had received an increase in their income hence they could easily accommodate the changes, other had to sacrifice and sell pieces of land so that they could try and keep up with the growth trends. Improved road network resulted in better economic activities increasing the availability of raw materials used in building of sanitation infrastructure.

6.3. Exposure to bigger/different cities

Exposure to foreign habits by travelling to different parts of the country would result in copying of designs and products. This however applied to the lucky few who got the opportunity to travel out of the municipality. It is after travelling that one would come back and try to implement what they observed or were using so as to maintain the standards. Namazzi, a woman in her late 60s from the community recalled how travelling to work in a different part of the country enabled her to realize how easy improved latrines were to clean and this made her build an improved latrine upon returning from work. Exposure is however dependent on availability of money as without the funds it would be very difficult to maintain the standards one was living in. Caroline, an elderly woman from the community in her 70s recalled having a flush toilet due to exposure of the children travelling out of the country where flush toilets are very common and hence decided to help their parents in installing a cistern flush toilet so as to fit in with the foreign habits. Among other reasons, they did not want to direct their international visitors to an outside latrine: *“We developed and we used to have visitors... so that’s why we developed the toilets to the standards of living our children used to come with visitors from outside the country.”*

Improved road networks also resulted in improved connectivity among different towns and this facilitated migration in search of job opportunities and with movement new habits and practices were developed. Abdi, a man in his 70s supported this statement when he said that having the opportunity to work out the country enabled him to get accustomed to different sanitation practices and this led him to install a cistern flush toilet in his house.

The “cleanest village” competitions organised by the government among different villages ensured that community members maintained cleanliness and the awards given not only led to change of sanitation infrastructure but also a motivation to maintain the infrastructure by continuously cleaning and use of the latrine cover to keep the flies away.

6.4. Safety and Accessibility

Change from traditional pit latrines to improved latrines was associated with increased access to the elderly and the young. This mainly applied to the latrines that only had logs with no slab as most of the time rotten logs posed as a health hazard to the users. Reduced mobility due illness was among the reasons associated with sanitation infrastructure change so as to ensure access for everyone at all times. Families that had a member with disability, with reduced mobility, resorted to having an indoor flush toilet. For some, the installation was only possible with external help from children as recounted by Aisha, an elderly woman in her 80s from the community. *“It is my children who contributed as it’s a system to contribute to the family when we want to do something.”* For those whose family dynamics did not allow for family contribution they adopted practices such as using buckets which are to be emptied in the morning.

6.5. Availability of Water

Introduction to private yard connections encouraged those who were financially able to install cistern flush or pour flush toilets. However, this did not assure their consistent use due to seasonal water shortages and water related costs which forces the communities to have an 'emergency' infrastructure used during the day, during the dry seasons and during social gatherings.

To conclude, instead of a ladder summarizing the progress or development that has been experienced in the municipality through the years, we see that the infrastructure has never been homogeneous across the municipality. Its development has been uneven and it is mainly dependent on one's financial ability and on contingencies. Also, there have been changes that have been experienced in the municipality although they will not be recorded as progress or development by the sanitation ladder as it only recognizes the number of facilities installed (Okurut, et al., 2014).

Chapter 7

Discussion and Conclusion

This research has tried to answer how sanitation infrastructure has been transforming in Bushenyi-Ishaka. This was done by chronological presentation of infrastructure changes so as to capture the changes in sanitation infrastructure. The empirical data collected during field work revealed that majority of the community members were first forced into latrine use during the 1960s for fear of the authority of traditional chiefs and under threat of paying fines, imprisonment or both. The community has however maintained latrine use due to its associated benefits. While the community members were forced into building latrines, the upgrading to better infrastructure was a matter of choice and ability. It is worth noting that the municipality accords importance to improved sanitation as they did not only install the latrines, but started using them and maintaining them regularly. This is also evidenced by insignificant rates of open defecation within the municipality (Nyakutsikwa, 2018).

Sanitation service delivery involves multiple actors of which on-site provision at households is a self-managed process where community members apply different strategies to ensure that they have functioning sanitation infrastructure influenced their by socio-economic status (Nakagiri, et al., 2016) . The sanitation ladder does not consider circumstances where families modify a part of their infrastructure to realise the full benefits that come with having and using a latrine. In addition, basic latrines can provide more protection if they are emptied or sealed in a timely manner with an aim of ensuring that sludge is properly treated and or disposed in-situ (Foster V and Briceno, 2010). The current practice of sealing the pit latrines and planting banana trees ensures that the faecal sludge does not only become a breeding ground for flies and mosquitoes but also a source of nutrients for the banana plant making the practice environmentally and economically sustainable (Odey, et al., 2017).

From the analysis, it evident that the linearity associated with the sanitation ladder is far from accurate. This progress is not stepwise as portrayed by the ladder because of the sanitation changes that have been recorded in the municipality are not all going in one direction. There was a forceful change from open defecation to unimproved latrines which have been in use ever since for a majority of the community members. For those who were able to change their sanitation infrastructure they changed from unimproved to the flush toilets due to either availability of water or reduced mobility due to sickness. For those who have installed cistern flush toilets, their use is restricted to night use so as to minimise and reduce water use which automatically reduces water related costs. Intermittent water supply is a contributing factor for the usage of dry technologies (systems that do not require water to carry human waste) where some have been converted to a dry system so as to accommodate the sporadic water supply

(Obeng, et al., 2015). Many community members do not see flush toilet as a gold standard, as water supply is inconsistent and expensive.

Empirical data also suggests that infrastructural transformations are not only dependent on technology but also on socioeconomic factors, physical mobility (health), and water availability. For example, those with water availability only use the cistern flush toilets during the rainy season and at night due to the amount of water that is used to flush as it uses between 7-9 litres with each flush. Therefore they continue to use both types of infrastructure (latrines and cistern flush toilets) according to convenience. Community members acknowledged how uneconomical cistern flush are, feeding into the greater debate of sustainability where innovative technologies that use minimal water are being foregrounded as appropriate solutions by many agencies.

Those with reduced mobility are forced to improvise and use buckets which are emptied later. This would then present a setback in the sanitation ladder narrative, for those who use bucket latrines are categorized among the lowest rungs in the sanitation ladder signifying a descent in the sanitation ladder (Kwiringira, et al., 2014). This then showcases the fact that infrastructure is not a straight forward path.

In Uganda current progress in sanitation is mainly dependent on ability and financial status of the households and this is reflected by the type of infrastructure built. This finding is similar to various studies where provision of financial assistance resulted in change or adoption of better sanitation infrastructure (Chunga, et al., 2017). Present dynamics of the municipality of having both urban and rural characteristics influence how progress will occur due to the current distribution of infrastructure with the urban areas having improved facilities and the peri-urban having unimproved structures which have been modified so as to provide benefits. Due to house owners providing their own sanitation infrastructure, it is worth assuming that the type of infrastructure they put up will not be more than what they can afford for their basic needs unless they are able to access affordable financial plans (McGranahan, 2015).

To be accepted as having basic sanitation, a sanitation facility needs to be used exclusively by one household. In retrospect to 19% of the Ugandan national population having basic sanitation with urban and rural population access levels of 28 % and 17 % respectively (WHO, et al., 2015). This number would have been higher had present family dynamics in the peri-urban areas been taken into consideration. This is because most families live as several independent households within a compound where they share a latrine which is sealed upon filling. The family does not only prevent environmental degradation but also reuse the nutrients, however they do not qualify to be accepted as having access to basic services. The idea of excluding those who share latrines with safe in-situ disposal of faecal sludge may provide a blurry picture of sanitation practices and well-being and this would mean that only those that have the resources to acquire alternative expensive infrastructure are captured as “developed” or “progressed” in sanitation.

Exposure to foreign habits as a driver for infrastructural change was highlighted in the study, this was because people wanted to maintain what they had been using while they were away working. This finding is almost similar to a study in Benin where work related travel led to the adoption of latrine (Jenkins, et al., 2005) . The type of technology adopted did not necessarily reflect the ordered sequence in the sanitation ladder as most just wanted to install what they were using initially. Another driver for change was the improvement of road networks which lead to new markets, opening up of areas that were underserved. This in turn increased availability of raw materials which were easily distributed hence increasing the probability of infrastructure change. The strategic location of the municipality on Mbarara - Kigali - Fort Portal cross road also increased the accessibility and availability of raw materials and this therefore facilitated the change in trends visible in the municipality. This finding is supported by O’Connell, et al. (2015) who show how access to sanitation market and materials among other factors were important drivers of improved sanitation.

The adoption of different sanitation infrastructure was mainly related to choice and financial availability. The community members were able to choose what is convenient to them at that particular moment with no logical sequence of technology choice like it is portrayed in the sanitation ladder. Finances as a driver to infrastructural change has been mentioned in various studies (Chunga, et al., 2017, Sara, et al., 2014).

Here it is worth quoting Simone (2013 p,143) who in his study on Jakarta, argues that:

“People figure themselves out through figuring arrangements of materials, of designing what is available to them in formats and positions that enable them particular vantage points and ways of doing things.”

Findings from the research revealed how community members modified their sanitation infrastructure so as to provide privacy, used improvised brooms to ensure that their latrines were clean, poured ash to ensure their latrines were odourless. These improvisations are meant to increase latrine usage so as to avert a range of health problems caused by lack of latrines. Sanitation infrastructure or lack thereof shapes the way people relate to each other by developing routines and schedules (Rodgers and O’Neill, 2012), this would translate to adoption of practices due to inaccessibility of sanitation infrastructure for one reason or the other , going to relieve oneself before sleeping , having to hold until morning and having to accompany children to the facilities as identified as revealed by the study.

Findings from the menstrual hygiene management reveal use of pads as the ‘gold standard’ due to the ease in disposal unlike clothes which need to be washed and dried. This finding is similar to a study in Uganda where use of disposable pads is ‘synonymous’ to modernity (Scott, et al., 2013). While its use may be referred to as modernity, lack of appropriate sanitation infrastructure may result in reduced design life of pit latrines and blockages of sewerage systems which may result in sewerage backflow – a potential health hazard (Kjellen, et al., 2012).

This finding is confirmed in one of the schools that have an incinerator for burning used pads so as to maintain the design life of the ventilated pit latrines. Discussions around menstrual hygiene management, reveal how menstruation as a topic is not a taboo amongst family members especially mothers and their daughters but a taboo on the wider context and this was reflected by how uneasy the male head teacher was. In addition, having a senior woman who sensitizes and has ‘emergency menstruation supplies’ reveals the taboo to be gendered and this normally results in additional work for the senior woman. Despite, the work burden associated with menstruation, there are reservations towards male teachers as it may result to “*certain sexual tensions among adolescent girls*”(Joshi, et al., 2015 p,59).

In conclusion, pit latrines have been in use since pre and post-independence. Even for those who have cistern or pour flush toilets, they have a pit latrine that is used in the dry seasons and also during social functions. Community members have made improvements on their pit latrines which cannot be recognised by the sanitation ladder as development or progress as it only considers people who have access to certain types of technologies. Sanitation infrastructure development has been an uneven as people only progress according to their financial ability and therefore to facilitate equitable progress throughout the municipality interventions that suit the cultural and topographical conditions need to be considered. Development is contextual and the findings cannot be generalized for other small towns due to different factors that may have contributed to sanitation infrastructural and therefore sanitation ladder should therefore be contextual to accommodate the conditions affecting different regions.

7.1. Future Perspectives

Menstrual hygiene management may have not been fully explored and a study to understand how it has influenced sanitation infrastructure development in schools will be helpful. Understanding the drivers of sanitation infrastructural change in a city with a focus on informal settlements for comparison purposes.

References

- Adank M (2013) Small town water services:Trends,challenges and models The Hague
<http://www.irc.nl/top27>
- Adukia A (2012) Sanitation and Education. PhD, Harvard University
- Anand N (2012) Municipal disconnect: On abject water and its urban infrastructures.
Ethnography 13: 487-509
- Blackett I, Hawkins P (2016) Fecal Sludge Management Services Diagnostic and Decision-Support Tools: An Overview2016
- Bryman A (2012) Social research methods Oxford University Press, Oxford; New York
9780199588053 0199588058
- Cairns-Smith S, Haley H, Nazarenko E (2014) Urban Sanitation: Why a portfolio of solutions is needed The Boston Consulting Group
- Caplan K, Harvey E (2010) Small town water and sanitation delivery taking a wider view.
- Chunga R, Jenkins MW, Ensink J, Brown J (2017) Moving up the sanitation ladder with the help of microfinance in urban Malawi. Journal of Water, Sanitation and Hygiene for Development 8: 100-112 DOI 10.2166/washdev.2017.186
- Cohen B (2006) Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability. Technology in Society 28: 63-80 DOI 10.1016/j.techsoc.2005.10.005
- Dauda B, Gerald A (2017) Water Supply and Sanitation in Small Town Project Uganda
- Denscombe M (2010) The Good Research Guide for Small Scale Research Projects, 4 edn
Open University Press, Buckingham 9780335241385 29/04/2019
- Foster V, Briceno C (2010) Africa Infrastructure: a time for transformation. Washington DC, US
- Galvin M (2015) Talking shit: is Community-Led Total Sanitation a radical and revolutionary approach to sanitation? Wiley Interdisciplinary Reviews: Water 2: 9-20 DOI 10.1002/wat2.1055
- Genser B, Strina A, Teles CA, Prado MS, Barreto ML (2006) Risk factors for childhood diarrhea incidence: dynamic analysis of a longitudinal study. Epidemiology (Cambridge, Mass) 17: 658-667 DOI 10.1097/01.ede.0000239728.75215.86

- Harvey PE, Jensen CBE, Morita AE (2017) *Infrastructure and social complexity*, 1st edn
Routledge, London
- Hopkins R, Satterthwaite D, Lauria D, Walton B, Schoon C, Scott P, Smet J, Cresswell J,
Gasteyer S (2003) *Town Water Supply and Sanitation Services Companion Papers*
The World Bank Group, Washington,DC
- Hopkins R, Satterthwaite D, Lauria D, Walton B, Schoon C, Scott P, Smet J, Cresswell J,
Gasteyer S (2003) *TownsWater Sanitation Services Companion Papers* The World
Bank Group, Washington,DC
- Hotez PJ, Molyneux DH, Fenwick A, Kumaresan J, Sachs SE, Sachs JD, Savioli L (2007a)
Control of Neglected Tropical Diseases 357: 1018-1027 DOI 10.1056/NEJMra064142
- Hotez PJ, Molyneux DH, Fenwick A, Ottesen E, Sachs SE, Sachs JD (2007b) Correction:
Incorporating a Rapid-Impact Package for Neglected Tropical Diseases with Programs
for HIV/AIDS, Tuberculosis, and Malaria. *PLOS Medicine* 4: e277 DOI
10.1371/journal.pmed.0040277
- Humphreys E, van der Kerk A, Fonseca C (2018) Public finance for water infrastructure
development and its practical challenges for small towns. *Water Policy* 20: 100-111
DOI 10.2166/wp.2018.007
- Hutton G, Chase C (2016) The Knowledge Base for Achieving the Sustainable Development
Goal Targets on Water Supply, Sanitation and Hygiene. *International journal of
environmental research and public health* 13: 536 DOI 10.3390/ijerph13060536
- Jenkins MW, Curtis V (2005) Achieving the ‘good life’: Why some people want latrines in
rural Benin. *Social Science & Medicine* 61: 2446-2459 DOI
10.1016/j.socscimed.2005.04.036
- Joshi D, Buit G, González-Botero D (2015) Menstrual hygiene management: education and
empowerment for girls? . *Waterlines* 34: 51-67
- Kalbermatten JD, Julius , D.S., Gunnerson, C.G (1982) *Appropriate Sanitation Alternatives:
A Technical and Economic Appraisal* Johns Hopkins University Press, Baltimore.
- KCCA (2016) *Improving On-site Sanitation in Kampala City, Uganda* Kampala Capital City
Authority, Uganda.
- Kjellen M, Pensulo C, Nordvist P, Fogde M (2012) *Global Review of Sanitation System
Trends and*

- Interactions with Menstrual Management Practices Report for the Menstrual Management and Sanitation Systems Project Stockholm Environment Institute, Sweden, pp. 36.
- Koottatep T, Cooney PE, Polprasert C (2019) *Regenerative Sanitation: A New Paradigm For Sanitation 4.0* IWA Publishing, London 9781780409689 3/13/2019
- Kooy M, Bakker K (2008) Technologies of Government: Constituting Subjectivities, Spaces, and Infrastructures in Colonial and Contemporary Jakarta 32: 375-391 DOI 10.1111/j.1468-2427.2008.00791.x
- Kulkarni S, O'Reilly K, Bhat S (2017) No relief: lived experiences of inadequate sanitation access of poor urban women in India. *Gender & Development* 25: 167-183 DOI 10.1080/13552074.2017.1331531
- Kvarnström E, McConville J, Bracken P, Johansson M, Fogde M (2011) The sanitation ladder – a need for a revamp? *Journal of Water, Sanitation and Hygiene for Development* 1: 3-12 DOI 10.2166/washdev.2011.014
- Kwiringira J, Atekyereza P, Niwagaba C, Günther I (2014) Descending the sanitation ladder in urban Uganda: evidence from Kampala Slums. *BMC Public Health* 14: 624 DOI 10.1186/1471-2458-14-624
- Luthi C, Reymond P, Renggli S, Reynaert E, Klinger M, Sherpa A, Sherpa M, Mtika W (2017) *Small Towns : Research on Solutions for the Sanitation (planning) Gap.* Sandec News Sandec, Switzerland.
- Mara D, Drangert J-O, Viet Anh N, Tonderski A, Gulyas H, Tonderski K (2007) Selection of sustainable sanitation arrangements. *Water Policy* 9 DOI 10.2166/wp.2007.009
- Mara D, Lane J, Scott B, Trouba D (2010) Sanitation and Health. *PLOS Medicine* 7: e1000363 DOI 10.1371/journal.pmed.1000363
- McFarlane C, Desai R, Graham S (2014) Informal Urban Sanitation: Everyday Life, Poverty, and Comparison. *Annals of the Association of American Geographers* 104: 989-1011 DOI 10.1080/00045608.2014.923718
- McFarlane C, Rutherford J (2008) Political Infrastructures: Governing and Experiencing the Fabric of the City. *International Journal of Urban and Regional Research* 32: 363-374 DOI 10.1111/j.1468-2427.2008.00792.x
- McFarlane C, Silver J (2017) The Political City: “Seeing Sanitation” and Making the Urban Political in Cape Town 49: 125-148 DOI 10.1111/anti.12264

- McGranahan G (2015) Realizing the Right to Sanitation in Deprived Urban Communities: Meeting the Challenges of Collective Action, Coproduction, Affordability, and Housing Tenure. *World Development* 68: 242-253 DOI 10.1016/j.worlddev.2014.12.008
- Medland LS (2014) Developing standards for household latrines in Rwanda. Loughborough University
- Ministry of Health (1997) Uganda National Sanitation Policy <https://www.ircwash.org/sites/default/files/824-UG-14076.pdf>
- MOH (2014) Sanitation and Hygiene Situation Analysis in 15 Districts Uganda
- Morales MdC, Harris L, Öberg G (2014) Citizenshit: The Right to Flush and the Urban Sanitation Imaginary. *Environment and Planning A: Economy and Space* 46: 2816-2833 DOI 10.1068/a130331p
- Moriarty P, Batchelor C, Fonseca C, Klutse A, Naafs A, Nyarko K, Pezon C, Potter A, Reddy V, Snehalatha M (2018) Ladders for assessing and costing water service delivery
- Naghavi M, Abajobir AA, Abbafati C, Abbas KM, Abd-Allah F (2017) Global, regional, and national age-sex specific mortality for 264 causes of death, 1980-2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet* 390: 1151-1210 DOI 10.1016/S0140-6736(17)32152-9
- Nakagiri A, Niwagaba CB, Nyenje PM, Kulabako RN, Tumuhairwe JB, Kansiime F (2016) Are pit latrines in urban areas of Sub-Saharan Africa performing? A review of usage, filling, insects and odour nuisances. *BMC Public Health* 16: 120 DOI 10.1186/s12889-016-2772-z
- Naughton C, Mihelcic J (2017) Introduction to the Importance of Sanitation. In: B.Jimenez-Cisneros JBRa (ed) *The Health Hazards of Excreta: Theory and Control* Michigan State University, E.Lansing, UNESCO.
- Nyakutsikwa B (2018) Evaluation of existing services in Bushenyi and a comparison of the enabling environment with Kampala. Master of Science, UNESCO-IHE Institute for Water Education
- O'Connell KA, Devine J (2015) Who is likely to own a latrine in rural areas? Findings from formative research studies. *Waterlines* 34: 314-329 DOI 10.3362/1756-3488.2015.029
- Obeng P, Keraita B, Oduro-Kwarteng S, Bregnhøj H, Abaidoo R, Awuah E, Konradsen F (2015) Usage and Barriers to Use of Latrines in a Ghanaian Peri-Urban Community

- Obertreis J, Moss T, Molinga Pa, Bichsel C (2016) Water, infrastructure and political rule: Introduction to the special issue. *Water Alternatives* 9: 168-181
- Odey EA, Li Z, Zhou X, Kalakodio L (2017) Fecal sludge management in developing urban centers: a review on the collection, treatment, and composting. *Environmental Science and Pollution Research* 24: 23441-23452 DOI 10.1007/s11356-017-0151-7
- Okurut K, Charles KJ (2014) Household demand for sanitation improvements in low-income informal settlements: A case of East African cities. *Habitat International* 44: 332-338 DOI 10.1016/j.habitatint.2014.07.014
- Potter A, Klutse A, Snehalatha M, Batchelor C, Uandela A, Naafs A, Fonseca C, Moriarty P (2011) Assessing sanitation service levels Hague, The Netherlands
- Prüss-Ustün A, Bartram J, Clasen T, Colford JM, Cumming O, Curtis V, Bonjour S, Dangour AD, De France J, Fewtrell L, Freeman MC, Gordon B, Hunter PR, Johnston RB, Mathers C, Mäusezahl D, Medlicott K, Neira M, Stocks M, Wolf J, Cairncross S (2014) Burden of disease from inadequate water, sanitation and hygiene in low- and middle-income settings: a retrospective analysis of data from 145 countries. *Tropical Medicine & International Health* 19: 894-905 DOI 10.1111/tmi.12329
- Reymond P, Renggli S, Lüthi C (2016) Towards Sustainable Sanitation in an Urbanising World. In: Ergen M (ed) *Sustainable Urbanization*,
- Roche B (2000) Summary Report on Small Towns Water and Sanitation Small Towns Water and Sanitation Electronic Conference, One World Website.
- Rodgers D, O'Neill B (2012) Infrastructural violence: Introduction to the special issue. *Ethnography* 13: 401-412 DOI 10.1177/1466138111435738
- Rosenqvist T, Mitchell C, Willetts J (2016) A short history of how we think and talk about sanitation services and why it matters. *Journal of Water, Sanitation and Hygiene for Development* 6: 298-312 DOI 10.2166/washdev.2016.118
- Sara S, Graham J (2014) Ending Open Defecation in Rural Tanzania: Which Factors Facilitate Latrine Adoption? *International Journal of Environmental Research and Public Health* 11: 9854-9870
- Satterthwaite D (2016) Missing the Millennium Development Goal targets for water and sanitation in urban areas. *Environment and Urbanization* 28: 99-118
- Satterthwaite D (2016) Small and intermediate urban centres in sub-Saharan Africa

- Scott L, Montgomery P, Steinfeld L, Dolan C, Dopson S (2013) Sanitary Pad Acceptability and Sustainability Study <http://opendocs.ids.ac.uk/opendocs/handle/123456789/11944>
30-03-2019
- Simone A (2013) Cities of Uncertainty: Jakarta, the Urban Majority, and Inventive Political Technologies. *Theory, Culture & Society* 30: 243-263 DOI 10.1177/0263276413501872
- Sommer M, Kjellén M, Pensulo C (2013) Girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries. *Journal of Water, Sanitation and Hygiene for Development* 3: 283-297 DOI 10.2166/washdev.2013.101
- Strauss M, Larmie SA, Heins U, Montangero A (2000) Treating faecal sludges in ponds. *Water Science and Technology* 42: 283-290 DOI 10.2166/wst.2000.0662
- Thomas A, Alvestegui A (2015) Sanitation in Small Towns: Experience from Mozambique
- Tiley E, Ulrich L, Luthi C, Reymond P, Zurbrugg C (2014) *Compendium of Sanitation Systems and Technologies* Swiss Federal Institute of Aquatic Science and Technology(Eawag), Dübendorf, Switzerland
- Tutusaus M, Schwartz K (2018) Water services in small towns in developing countries: at the tail end of development. *Water Policy* 20: 1-11 DOI 10.2166/wp.2018.001
- UBOS (2016) *The National Population and Housing Census 2014-Main Report* Kampala,Uganda
<https://www.ubos.org/onlinefiles/uploads/ubos/NPHC/NPHC%202014%20FINAL%20RESULTS%20REPORT.pdf> 21/11/2018
- UBOS, ICF (2018) *Uganda Demographic and Health Survey 2016*. Kampala,Uganda and Rockville,Maryland ,USA
[https://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/Uganda DHS 2016_KIR.pdf](https://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/Uganda_DHS_2016_KIR.pdf) 15/11/2018
- Uganda SD (1995) *Uganda Demographic Health Survey* Calverton,Maryland
- UNDESA (2010) *World Urbanization prospects 2009 Revision*. United Nations,New York
- UNICEF (n.d.) *Water, Sanitation and Hygiene in Schools-National Standards in Uganda*, Uganda.
- WHO (2018) *Guidelines on sanitation and health*, Geneva, Switzerland

- WHO, UNICEF (2008) Progress on Drinking water and Sanitation Special Focus on Sanitation. Geneva, Switzerland <http://www.who.int/iris/handle/10665/43931> 26-11-2018
- Wash Data (2015) <https://washdata.org/data/household#!/table?geo0=country&geo1=UGA>. Cited 25/03/2019
- WHO, UNICEF (2017) Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines Grojec A Geneva, Switzerland
- Yin RK (1994) Case study research: Design and Methods, 2, illustrated, reprint edn Sage Publications 9780803956629
- Yin RK, Campbell DT (2018) Case study research and applications : design and methods, 6 edn Sage Publisher, Thousand Oaks, California 9781506336169
- Zimmerman J, Mark E (2015) Progress on Sanitation Ladder during the MDGs College of Engineering, Civil, Construction and Environmental.

Appendices

Appendix A Sanitation infrastructure in the town



Appendix B Latrine Construction



Appendix C Photos from the field

