EVALUATION OF THE PROVISION OF SEWERAGE SERVICES AMONG THE RESIDENTS OF KENOL TOWN, MURANG'A COUNTY, KENYA

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ABSTRACT

Globally about 2.6 billion people do not have efficient sanitation services. Most of these challenges are found in third world countries that lack sufficient and adequate drainage and solid waste management strategies. Most countries in the sub-Saharan Africa have settlements that are inadequately supplied with sewage services. Kenol town in Murang'a County emerged as a market Centre in the 1990s and a petrol station. It subsequently grew into an urban settlement with little or no prior planning. The town grew rapidly as a sub County head quarter leading to sharp increase in population that needed among other social amenities housing. This has created a challenge on provision of sewerage services in the town. The study aimed at evaluating the provision of sewerage services among the residents of Kenol town, Murang'a County, Kenya. The study adopted a descriptive study design, the target population was 778 individuals. Both qualitative and quantitative data were collected from 264 respondents using interview guides and questionnaires. Collected data were analyzed using SPSS Version 21. Descriptive and linear regression statistics were used analyse the data and help to establish existing relationships between the independent variables and the dependent variable. The study established that there were numerous factors could be implied for poor provision of sewerage services to residents of Kenol town. Unplanned settlements was found to have a significant relationship (coefficient= -2.701, df=1, p= 0.036) with poor provision of the sewerage services. Thus, the study recommends that the County Government should ensure that all buildings and any other form of settlement are planned prior to construction to enable easy provision of the services. The County Government should formulate a policy which puts strict and punitive measures to any individual who does not adhere to physical planning and sewerage designs while setting up any structure. These findings may improve the status of other urban centres that are coming up and ease provision of sewerage services.

Key words: Sewerage services, urban planning, unplanned settlement

1. Introduction

Sewage comprises 99.94 % water, with only 0.06 % being dissolved and suspended solids (Karen, 1996). The world urban population, according to the world urbanization prospects; the 2007 revision, is projected to double by 2050 from 3.3 billion in 2007 to 6.7 billion. This has an impact on the provision of some vital social services like sewerage and drainage services. A survey carried out by the national sample survey office (NSSO, 2015), showed that about 2907

urban blocks in India (about 56.4%) of the sections in towns have a sewerage network. NSSO survey also showed that 8.6% of the urban wards do not have anyone to clean the toilets. This is brought about by the unsafe disposal of the bulk of human excreta due to surges in population densities in the given urban areas. Clogging may the end result if it is directed into piped drain.

UNICEF and WHO, (2015) declared sanitation a right for all the people in the universe. About 2.4 billion people don't have access to a fairly improved sanitation. A lot of emphasis should be laid on the need to multiply its access in the world. With the new challenges of the Sustainable Development Goals (SDGs) in the whole world which indeed have to be achieved by 2030, sanitation and hygiene which is available, affordable and enough for all must be made accessible, (United Nations, 2015).

According to WHO, (2016) proper disposal of the human feaces and urine safely and in a hygienic manner is all that is meant by the term sanitation. As per the United Nations (2010), sanitation is the whole organization of collecting, transporting, treating and disposing or re-using human excreta having in mind the required hygiene.

This right should be availed to everyone without discrimination in an acceptable, safe and in a culture that is acceptable universally. (United Nations Economic and Social Council, 2010). Proper disposal of sewage in a hygienic manner minimizes contamination by humans to diseases like diarrhoea by 65%, (WHO and UNICEF, 2000). It also majorly affects the productivity and the enrolment in schools which then have a direct influence on social and economic development as a whole (Mara, *et al.,* 2010). To provide sewerage services to the whole universe is an uphill task. According to UNICEF and WHO, (2015), about 70% of the population in rural areas does not have access to sewerage services. Most of the people without this access are mostly in the rural areas, (United Nations, 2015).

A report by (UNICEF & WHO 2012) stated that regions provided with sanitation in developing countries are at 49 per cent. Moreover, most countries sub-Saharan Africa have improved sanitation more than half of those who do not have improved sanitation. Similarly, about 1.5 billion Indians and Chinese do not have improved sanitation services. The ever-increasing population in towns, urban areas and cities especially in developing countries is adding pressure on demand for housing and provision of sanitation services. It is also an uphill task to provide these sanitation services to the population that is located in undesignated residential areas like the slums.

A third of the population in the world uses the onsite sanitation technologies. With good care and management they work efficiently and properly. However, most of the developing countries do not have Faecal Sludge Management, (World Bank Water Supply and Sanitation Program, 2014). This implies that about 42% of excreta are left to flow freely in the environment in urban areas. This in turn brings about other health hazards to the population in general.

A huge chunk of waste is left to the open environment directly. In low income settlement areas this discharge is even worse. Effluents especially from septic tanks are discharged into the open streams and drainage canals. Overcrowding which is brought about by the increasing number of people in urban areas and the growth of towns has triggered the focus to be on the improvement of improved basic sanitation. However, this service calls for heavy investment on provision of trunk sewerage, collection and disposal facilities. These plans are dragged by lack of financial

and institutional access. Another hindrance is inability to cope with the speed at which the population is growing at in the developing countries and the scarcity of funds, (WHO/UNESCO, 2006).

In Africa, most of the urban centres have low coverage by sewerage network with less than 10% population of the urban being connected. High cost of connections which require huge investments to provide sewerage services contribute to this low coverage, (Human Development Report, 2006). African countries have not been left out. Ghana, Ethiopia, and Rwanda have sanitation problems. Rwanda Water and Sewerage Sanitation and Bank Groups contribute towards meeting the international development goals on sanitation. However, insufficient sanitation infrastructure, especially in rural areas influences the sanitary conditions. There are substantial differences while accessing data availability from various sources, due to use of different characterizations by different institutions that provide access to data, (Buller, 2006).

In Ghana, about a third of the sewerage supply services is not functional, most of which operate far below capacity. It was projected that 85% of Ghana would be covered by 2015 at a rate of 78%. About 763,698 m³ of sewage was estimated to be generated in a day by urban areas of Ghana in the year 2000. Only a small percentage of the sewage in towns is collected, and another small percentage is treated. In Accra, approximately 10% is collected from the collected sewerage, (Ghana Environmental Protection Agency, 2001).

A report given in 2001 by the Ghana Environmental Protection Agency indicated that a quarter of treatment plants which totaled 46, all comprising of industrial and municipal treatment plants were functioning properly. Local governments operate urban sewage treatment plants. In the late 1990s, a biological treatment plant was built at Accra's Korle Lagoon. It has been a challenge to the whole nation, the major concern being when the country will be able to handle sewerage problems, (Kinoti, 2010).

In Uganda, a good example of onsite sanitation technologies is a pit which stores excreta. In Tanzania, 90% of the sewage is catered for by onsite systems of which 23% is left open with no treatment at all, (World Bank Water Supply and Sanitation Program, 2014).

In Kenya, the provision of sewerage services poses a major challenge. This is because of high poverty levels for example in Nairobi, Kibera area where there are broken and open sewers. The sewerage infrastructure was designed in the 1960's, (Omotto of Umande Trust, 1960). Standard Newspaper, (2012) reported that the collapsed sewerage services may force Nairobi City to close down if no measure is taken urgently.

Population increase and pressure has grown to uncontrollable levels therefore making the sewerage system to burst at the seams. The report also says that this system was to serve about a million people but now serving a population that is three times what it was meant to serve, (Standard Newspaper, 2012). The Nairobi City County government is unable to serve the surging population and unplanned settlements which make it unable to provide this essential service. The sewer is less than 30% of the city's total 696 km^2 and only 20% of population connected to sewerage system. Kenya built its first Sewerage system at Kariobangi in Nairobi in 1961. This was just before Kenya got her independence. In Dadora, the second water treatment plant was established in 1980. It was then improved in 1994 as Dadora Estate and Treatment System (DEST). As a result, waste discharge in liquid form reduced significantly. According to The

Standard Digital, (2012), in urban areas that do not have sewerage systems, untreated water is still being left to the open fields and environment.

Moreover, due to poor maintenance, the Kariobangi plant stalled in its functioning and raw sewage is discharged to the Nairobi River without any proper treatment, (Kinoti, 2010). According to Davis, (2005), the sewerage services in Kenya have been characterized by many challenges some of which are institutional in nature. The Water and Sewerage Department (WSD) was faced with a problem of maintaining qualified staff as it would be uncompetitive compared to available parastatals and individually owned firms. The morale of those who remained was said to be low.

The rate of urbanization in Kenya is high. It is rapidly driven by rural-urban migration among other factors (UN-HABITAT and UNEP, 2010). The ever-increasing number of people in towns leads to emergence of unplanned settlements. The need by middle class to develop their own residence has facilitated in the expansion of suburban and peri-urban centres. Most suburban areas are unplanned and developers take advantage of the weak regulatory framework and the inconsistent regulatory capacity of the local authorities, Urban Areas and Cities Act, (2011). WHO and UNICEF facilitated the Environmental Sanitation Programme, (2010) in Kenya to help in developing, establishing better waste disposal methods and create awareness on proper sanitation to the population in the rural areas.

In 2015, Murang'a County Assembly received a report from the public participation committee on new planning of Kirathani market. It indicated that some towns like Kenol, Makuyu and Kandara are filth choked with urinals and sewage which are channeled to open drainages. A report tabled to Murang'a County Assembly, (2015), pointed out that sewerage services needed to be expanded and to initiate new ones. It was reported that towns such as Kenol, Kandara, among others are choking with filth. Waste from latrines and urinals, is directed to the open drainages. During the debate session, the motion on resolving the challenges facing the provision of sewerage services in the county was seconded by majority of the members. It was argued that, the sewerage services should equally be considered when the buildings are coming up. It was also reported that in almost all towns septic and dirt collection tanks are installed outside the buildings. In most cases, the overflowing effluent along the roads poses serious environmental degradation problems which include water related diseases, (Kenya Environmental Sanitation and Hygiene Policy 2016-2030).

Kenol town started as a market place and a stopover point for oil refiling of vehicles along Thika and Murang'a road. A Performance Audit Report on provision of sewerage in major towns in Kenya (2018) made some major findings among them challenges of unplanned structures, rapid population growth which leads to raw sewage discharge into the environment. Lack of a legal framework, disjointed and overlapping policies have also been blamed for a challenge in provision of sewerage services in towns.

2. Problem Statement

Most of the urban and suburban areas are unplanned and developers tend to overlook on the weak regulatory framework and the poor regulatory capacity of the local authorities. To provide sanitary education and improve methods of waste disposal in rural areas, WHO and UNICEF supported the environmental sanitation programme in Kenya. Sanitation policies in Kenya are formulated by The Ministry of Public Health and Sanitation. Legal framework has been provided

by the Kenya government. Kenol has not been able to provide sewerage services that are working efficiently.

2. Literature review

Globally, according to UNICEF and WHO, (2015) a high number of population (68% to 70%) cannot access sewerage services due to rapid development of unplanned settlements and mushrooming shacks in cities and urban areas. Slums or informal settlements are majorly inaccessible and provision of the basic services is practically unavailable. The areas that would otherwise be used as pathways for the laying out the sewerage systems are occupied. No allowance is available for the establishment of any infrastructure.

According to UN Habitat (2015), unplanned settlements or informal settlements are places inhabited by residents without security of tenure, areas which do not have the basic services and the houses do not conform to plan and regulations laid by the institutions.

The population growth in the United States of America, (USA) has rapidly grown especially in the nineteenth century, (UNDP, 2016). Less than 5% of all the population in America lived in cities in 1820. This percentage increased to about 16% by 1860 and by 1880, the population had shot up to 22.5%. Some cities in America like New York increased tenfold, Boston's eightfold and Washington, D.C. increased fivefold. As the population increased, vital services became inadequate and the capacity to hold it was not there. New homes which were sometimes unplanned could not be handled or monitored effectively and therefore capacity limits could be reached.

A report given by Oloo et al., (2016) indicates that India and many developing countries' have 33-37% urban population living in slums or in unplanned settlements. These dwellers stay in unconducive environments with no sewerage systems. They also face demolition without prior notice. There has been a problem of making the unauthorised houses legal in order to improve sewerage provision to the residents and consequently improve their living conditions. The government, however, is working hard to offer these sewerage services to house owners to enhance quality of service. Toilets are also being offered and efforts are being made to decentralize sewerage systems. Smallbore sewers and inceptor tanks carry the liquid waste and solid waste respectively the main pipeline for disposal. Time to time de-sludging and periodic removal of solids from these tanks is done for proper management at the local level (Vikram, (2016).

The removal of wastewater (greywater also called sullage) from urban areas is termed as urban drainage. Sullage includes all wastewater mainly from basins, washing machines and baths. According to McDonough & Braungart, (2002) there is no waste at all and waste from one stage is an input for another stage. Unplanned and informal settlements are as a result of poor migrants move to the towns to look for a place where they can build a shack for free. They settle on the open land which is just near a town and consequently readily take any wage given wherever they get a job. They waste a lot of time while accessing their places of work. The settlement on such land is illegal which means that there is no planning hence there are no services that are offered. There are no plots that are demarcated and allocated to these settlers, (McDonough & Braungart, 2002). Moreover, there is no structured drainage system and sanitation. In general, many problems are associated with unplanned and informal settlements such as poor drainage and

sanitation which can easily be solved by proper planning; funding and good engineering which also entails proper use of the modern technologies.

According to Kinoti (2010) most of the consumers acknowledged the problems involved in sanitation are part of life in the urban areas. This is not so when there is disease outbreak and the times of epidemics. To do away with these conditions brought about by discharges into the streets, the residents build privy vaults and cesspools.

Infrastructure is an organized and a systematic framework that strengthens the ability of the community to achieve its mandate of laying a foundation for individuals to contribute to development and ensure that there is social equity (Davis, 2005). It can also be said to be a trust upon which each and every individual relies and aspires to advance and tap daily socio-economic opportunities. This is beneficial to every individual when it works efficiently whereby the end product is seen on the development of the whole community. On the contrary when it works below the laid standards and expectations, everybody pays for it expensively, (Akinola, 2002).

Several countries world over have started using treated sewage as a resource especially the Middle East countries.

According to Kandiah, (1994), a well and clearly thought out sewage reuse strategy transforms the effluents to an environmentally sound and a viable economic resource. Thus, governments are expected to develop, control and establish policies on sewage reuse. This should be within national plan and national effluent use policy water resources. The governments and local authorities that are mandated with the treatment and disposal of sewage responsibilities must allocate the costs among other factors in establishing the relevant infrastructure for the effective system for sewage reuse such as irrigation.

In South Africa, 13.4% of the population resided in informal dwellings or shacks, StatsSA (2009). Here, residents survive in temporary shelters which are generally made of scavenged corrugated galvanized iron, plastic materials, cardboard or timber sheeting material. There is hardly any drainage in such urban areas resulting into environments that are much polluted with sewage (green water and also faecal matter). These informal settlements and unplanned structures in South Africa are mostly as a result of the poor migrants in to the towns.

Chirisa (2017) suggested that more decentralized and centralized sewerage services are needed. It is also necessary to introduce the recovery of nutrients and improved substances control into sewerage services in the major developed cities. Localized sanitation is increasingly growing in use in developed cities. The approach to the provision of services dramatically changes in future as the systems are smaller in size thus requiring less capital and funding for them to be installed. Decentralized systems are therefore better in solving problem of demand in improving and expanding the services (Buller, 2006).

This is reserved to county governments. For example, Nairobi County government is mandated to see to it that the city is clean at all the time. This endowment has ascertained that it is a difficult endeavour to most county governments due unavailable resources and the high degrees of corruption.

Interestingly, some communities have organized themselves to form CBOs and youth groups with an aim of managing the waste and get some income. This has led to creation of employment opportunities. The plant gets its raw material from the dump site.

Likewise, Green Loop International Company (GLI) which is found in Kikuyu town recycles plastic wastes. The Green Loop International collects and recycles plastic wastes. This in turn helps in providing a good and clean environment as well as in job creation (Water Impact Report, 2015). Kenyan urban areas have been growing at an average rate of 4.3% annually (KNBS 2005 -2016 period). The inadequate potential combined with economic difficulties has hindered the design of solutions to the challenges brought about by rapid urbanization.

Informal settlements are in the lowest strata in the poor class of houses. They can be singled out from the others because they are poorly structured and are generally semi permanent. Their walls are made of mud or even timber with the roofs having diverse material such as grass, polythene papers or hard cartons. Some of them are not even planned hence they are faced with the problems of sewerage and sanitation accessibility and supply, Urban Water, Sanitation and Solid Waste Services, (2017)

Unprecedented growth of urban areas has led to poor living standards which are caused by degradation of the environment and inefficiencies in economy. They grow without proper physical development plans and so in Kenol town in Murang'a county. Moreover, most urban developmental plans when done have been reactionary and only 30% of urban centres in Kenya are actually planned for. This is hugely due to fast population growth and planning capacity which is not adequate. Those county governments which have planning units are 4 out of 175 and they include Eldoret, Kisumu, Mombasa and Nairobi.

This has resulted in most towns struggling and dealing with mushrooming settlements that are not planned, all kinds of pollution, traffic menace, very expensive and inefficient transport system.
Kenya is at present characterized by urban slums which do not have proper sanitation.
The high and fast urban growth rate has given forth some challenges both, social and economic. Due to the ever increasing population much strain on the already available infrastructure such as housing and health facilities is felt. There is a rise in congestion in towns, increased number of informal settlements which leads to low quality life and poor living standards. About 15% of the population in urban centers lives in informal settlements, KNBS, (2009).

The informal settlements house is projected to accommodate to over 60% of urban population (Republic of Kenya, 2012). It is therefore the role of the government and its institutions to construct an elaborate plan for harvesting and or disposal of the sewage. Sewerage supply, other than capital, energy and communication is a very vital infrastructural requirement if sustainable development is to be achieved.
According to Water Impact Report, (2015), sewerage supply enhances human health and is very important for development of industries and commercial sectors. Economic development is mainly hindered by severe water shortage which directly influences people's health in certain areas. Life in urban areas is greatly supported by water resources. When this resource is properly utilized, it generates some interest on it in the universe.

3. Methodology

For an in-depth exploration of this phenomenon, this study adopted a descriptive research design. This determined the challenges in the provision of sewerage services in Kenol town in Murang'a County. Data was gathered within a period of three months starting from 21st March to 31st May 2019. Descriptive design was reasoned to be suitable for this study because it framed out the backdrop regarding examining the challenges in providing sewerage services taking case of Kenol town, in Murang'a South sub-county. Qualitative approach made available in-depth explanations and quantitative approach on the other side makes available the hard data required to meet the required objectives, (Mugenda & Mugenda 1999).

This study adopted descriptive research design. The target population was 778 individuals comprising of domestic and commercial consumers of sewerage services, management employees of Murang'a South Water and Sanitation Company and workers of Murang'a South Water and Sanitation Company based at Kenol town.

A sample size of 264 was arrived at from a target population of 778 as per (CDPO, 2012) aided by Yamane (1967) formulae.

$$n = \frac{N}{1 + N(e^2)}$$

n = Target population, N = total population, e = desired level of precision, N = 778, e = 0.05

$$n = \frac{778}{1 + 778(0.05^2)}$$

$$n = 264$$

The study used stratified sampling method to study select participants. The sample size distribution is indicated in Table 1 below.

Table 1. Sample Size Distribution

	Institution	Frequency	Percentage
1	MUSWASCo Management Officers	15	5.68%
2	Domestic sewerage service Consumers	200	75.76%
3	Kenol Hospital Employees	7	2.27%
4	Sub County Office Employees	7	2.65%
5	Sub County Commissioner's Office Employees	8	3.03%
6	Golden Palm Hotel Employees	10	3.79%
7	Kenol Academy Staff	12	4.54%
8	Kenol Computer College Staff	5	1.89%
	TOTAL	**264**	**100.0%**

Source: Researcher (2018)

Questionnaires were used to collect data from Sewerage service consumers and commercial sewerage services consumers. Interview was administered to MUSWASCo officers and company workers. Qualitative data were analyzed thematically along the study objectives and presented in narrative forms. Quantitative data were analyzed using frequencies and percentages descriptively and inferentially using linear regression analysis with the help of Statistical Packages for Social Science (SPSS Version 21) and presented using tables.

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4. Research Findings

The study sought to establish how settlement patterns influence provision of sewerage services. Descriptive data collected from consumers of sewerage services were given in Table 2.

Table 2: Views of consumer of sewerage services on the influence of settlement on provision of sewerage services

Summary of Test Items	SA %	A %	U %	D %	SD %
There is no easy access to sewerage services.	71.4	12.1	1.5	10.1	5.3
Buildings are not well planned.	66.9	13.2	2.4	12.7	4.8
Sewerage services are hindered by unplanned settlements.	80.5	12.4	1.6	3.3	2.2
Unplanned settlements outnumber the staff providing the sewerage service.	67.4	19.7	3.5	5.3	4.1
The company is serving a high number of settlements.	69.6	13.8	1.6	10.6	4.4

Source: Field Data (2019)

Table 6 reveals that majority (71.4%) of the consumers of sewerage services strongly agreed with the view that there is no easy access to sewerage services. At the same time, (12.1%) of the consumers of sewerage services agreed with the statement. However, only (1.5%) of the consumers of sewerage services were undecided, (10.1%) disagreed whereas (5.3%) strongly disagreed.

(66.9%) of the consumers of sewerage services strongly agreed with the view that buildings are not well planned as did (13.2%) of the consumers of sewerage services who agreed. At the same time, (2.4%) of the consumers of sewerage services were undecided, (12.7%) disagreed whereas (4.8%) strongly disagreed. According to KNBS (2016) urban areas in Kenya have been growing at an average rate of (4.3%). According to KNBS (2016), the settlements grew without proper physical development plans and so in Kenol town in Murang'a county.

Moreover, most urban developmental plans when done have been reactionary and only (30%) of urban centres in Kenya are actually planned for hugely due to fast population growth and planning capacity which is not adequate. In summary, inability of the residents to efficient and easy access to sewerage services is due to fast population growth poor planning of the buildings and settlement patterns.

(80.5%) consumers of sewerage services strongly agreed with the view that sewerage services are hindered by unplanned settlements as did (12.4%) of the consumers of sewerage services who agreed. However, (1.6%) of the consumers of sewerage services were undecided, (3.3%) disagreed whereas (2.2%) strongly disagreed.

KNBS (2016) also noted that inadequate potential combined with economic difficulties has hindered the design of solutions to the challenges brought about rapid urbanization. Unprecedented growth of urban areas has led to poor living standards which are caused by degradation of the environment and inefficiencies in economy. They grow without proper physical development plans. These findings imply that planning of settlements is a major

determinant of the extent to which residents access easy and efficient sewerage services in any urban area.

Majority of the consumers of sewerage services (67.4%) strongly agreed with the view that unplanned settlements outnumber the staff providing the sewerage service.(19.7%) agreed. However, (3.5%) of the consumers of sewerage services were undecided, (5.3%) disagreed whereas (4.1%) strongly disagreed. Buller (2006) noted that provision of sewerage services has become a difficult endeavour to most county governments due unavailable resources, inadequate staff and the high degrees of corruption.

According to Water Impact Report (2015), to mitigate on this shortage of workers, communities have organized themselves to form CBOs and youth groups with an aim of managing the waste and get some income.

This has led to creation of employment opportunities. This indicates that the success of any sewerage company to offer services depends largely on the adequate number of workers it has to meet the needs of consumers of sewerage services. From Table 6, majority (69.6%) of the consumers of sewerage services strongly agreed with the view that the company is serving a high number of settlements as did (13.8%) of the consumers of sewerage services who agreed. (1.6%) of the consumers of sewerage services were undecided, (10.6%) disagreed whereas (4.4%) strongly disagreed. Republic of Kenya (2012) report pointed that county governments have planning units and that 4 out of 175 have been struggling and dealing with mushrooming settlements that are not planned, all kinds of pollution, traffic menace, very expensive and inefficient transport system. According to RoK (2012), provision of sewerage services is overwhelmed by many households that need service since informal settlements house is projected to accommodate to over (60%) of urban population. These findings point that efficient provision of sewerage services depends on the number of households. This indicates that, in designing sewerage system, the planners need to factor in the number of households to be served.

4.1 Inferential Findings on the Influence of Settlement Patterns on Provision of Sewerage Services

H_{01}: There is no statistically significant relationship between unplanned settlements and provision of sewerage services in Kenol town of Murang'a County.

To verify the possibility of relationship between settlement patterns and provision of sewerage services, data were collected on the number of unplanned settlements in the four sections of Kenol Town and the number of consumers accessing sewerage services in those sections and results are shown in Table 7.

Table 3: Results of the number of unplanned settlements and the number of Consumers Accessing Sewerage Services

No. of Unplanned Settlements	No. of Consumers Accessing Sewerage Services
7	91
17	47
23	39
32	22

Source: Field Data (2019)

Table 7 indicates that, from the four sections of Kenol Town, the higher the number of unplanned settlements, the lower the number of consumers accessing sewerage services. The ability of sewerage companies to offer sewerage services to consumers largely depends on the manner in which different settlements within the town are planned. According to KNBS (2016) that planning of settlements is a major determinant of the extent to which residents access easy and efficient sewerage services in any urban area. These results were subjected to linear regression analysis and results are shown in Table 8.

Table 4: Linear Regression Analysis Showing Relationship between Number of Unplanned Settlements and Numberof Consumers Accesing Sewarage Services

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	103.088	11.416		9.030	.012
	Number of Unplanned Settlements	-2.701	.525	-.964	-5.144	.036

a. Dependent Variable: Number of Consumers Accessing Sewerage Services

Source: SPSS Generated (2019)

Table 8 shows linear regression analysis which generated a linear regression model of the form; **Number of Consumers Accessing Sewerage Services = 103.088 – 2.701 Number of Unplanned Settlements.** These results from the linear regression equation indicate that the coefficient for the number of consumers who access sewerage services attributed to the number of unplanned settlements is -2.701. This implies that with increased number of unplanned settlements, the number of consumers who access sewerage services is expected to decrease by a factor of 2.701 (though negative coefficient). The value 103.088 indicates that number of consumers accessing sewerage services not only dependents on planning of settlements, but a multiplicity of other factors such as socio-economic status of consumers to afford the services and attitude towards the service delivery.

From the results in Table 8, the p-value, 0.036 is less than 0.05, that is, a low p-value (0.036< 0.05) which indicates that the null hypothesis, **H_{01}**, is rejected. Thus, there is statistically significant relationship between planning of settlements and provision of sewerage services. Hence, proper planning of settlements should be carefully thought out as key determinant of consumers' easy access to efficient sewerage services in any urban area.

4.2 Thematic Analysis of Qualitative Findings on the Influence of Settlement Patterns on Provision of Sewerage Services

MUSWASCo Management Officers and company workers were also interviewed. They also responded in favor of the view that there is no easy access to sewerage services to residents. According to the interviewees, unplanned settlements within the urban and sub-urban areas make it difficult to provide sewerage services. On further probing, MUSWASCo Management Officers, MMO1, noted;

> *It is not easy to provide sewerage services to many consumers due to unplanned settlements. Many settlements in urban and sub-urban sections of*

> *Kenol Town are poorly designed and buildings are haphazardly set up in a manner that makes it difficult to provide sewerage services*

KNBS (2016) noted that the inadequate potential combined with economic difficulties has hindered the design of solutions to the challenges brought about rapid urbanization. According to KNBS (2016) urban areas grow without proper physical development plans and so in Kenol town in Murang'a county. These views further indicate that poor planning of settlements make it difficult for consumers to have easy access to sewerage services. On availability of staff, MUSWASCO Management Officers and company workers concurred with the consumers that company staff are not enough. On further probing, company worker, CW1, observed:

> *Sometimes, it is very difficult to respond and address immediate needs and complaints from consumers due to too much workload attributed to inadequate number of sewerage staff in the company*

These views further support the views expressed by Buller (2006) that provision of sewerage services has become a difficult endeavor to most county governments due unavailable resources, inadequate staff and the high degrees of corruption.

According to Water Impact Report (2015), to mitigate on this shortage of workers, communities have organized themselves to form CBOs and youth groups with an aim of managing the waste and get some income. This has led to creation of employment opportunities. Further, this implies that the success of any sewerage company to offer services depends largely on the adequate number of workers it has to meet the needs of consumers of sewerage services. MUSWASCO Management Officer, MMO2, further noted:

> *The inability to respond to consumers' urgent need for sewerage services is attributed to a high number of households is served by the company compared to the number of staff available.*

According to Republic of Kenya (2012) the county governments have planning units and 4 out of 175 have been struggling. They are dealing with mushrooming settlements. They are not planned, they have all kinds of pollution, traffic menace and they are very expensive and have inefficient transport system. According to RoK (2012), provision of sewerage services is overwhelmed by many households that need service since informal settlements house is projected to accommodate to over (60%) of urban population. Hence, these views, as did the quantitative findings, point to the fact that provision of sewerage services depends on the number of households.

5. Concussion

From the findings, there is no easy access to sewerage services to residents. Unplanned settlements within the urban and sub-urban areas make it difficult to provide sewerage services. In other words, poor planning of settlements and inadequate number of trained company staff make it difficult for consumers to have easy access to sewerage services. It is also evident that financial resources allocated for sewerage services are often inadequate which hinder provision of sewerage services.

6. Recommendations

On settlement patterns, the County Government should ensure that all buildings and any other form of settlement are planned and designed in a manner not to interfere with the pathways for construction of sewer lines.

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