

Investigating the water supply situation in Naivasha municipality, Kenya

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Water supply is vital for human survival and good health. Water supply problems are a big challenge to many municipalities in Kenya and Africa as a whole. This study was a cross-sectional survey to establish the water supply situation among households living in the high, middle and low income areas. Data was collected on water access, alternative water sources, water quality, per capita water use and cost of water. Results showed that water demand outstripped supply and people resorted to using boreholes which had more reliable supply. The study showed that the respondents were able to access water as per the minimum required quantities postulated by the WHO guidelines. However, the middle and low income spend more than the stipulated proportions of their income on water. Water usage was significant depending on the number of household members and the amount of household activities that required water use per day. The achievement of the MDG goal of halving the proportion without access to safe water was hampered by challenges of urbanization and rapid population growth. More efforts were to be increased to mitigate the inequalities in water access, reduce incidences of water related diseases and have an overall improvement on health.

Key words: Water access, water demand, per capita water access, cost of water, Kenya.

INTRODUCTION

Water supply is the process of self-provision or provision by third parties in the water industry, commonly a public utility, of water resources of various qualities to different users (Lenntech Water Treatment & Purification Holding B.V., 2009). Water is indispensable for all forms of life. It is needed in almost all human activities and forms of life. Access to safe freshwater is regarded as a universal human right. The Millennium Development Goal seven targets are to halve the proportion of people without access to safe drinking water by 2015 (Kundzewicz et al., 2007). Sustainable management of freshwater resources has gained importance at regional and global scales with integrated water resources management now becoming the new paradigm shift in sustainability of water resources (Kundzewicz et al., 2007).

Various activities need water supply for operations such as residential/domestic, commercial, recreational, industrial and agricultural which takes up the largest amount of water supplies. Food and agriculture are the largest consumers of water, requiring one hundred times more than is used for personal needs (Lenntech Water Treatment & Purification Holding B.V., 2009). Up to 70% of the water taken from rivers, lakes, and groundwater

goes into irrigation, about 10% used in domestic applications and 20% in industry (Lenntech Water Treatment & Purification Holding B.V., 2009). Pressure to water resources due to irrigation would be increased till 2050 (Valipour, 2014). Globally, water for household consumption only accounts for less than 10% of the overall human water use, therefore does not pose a major threat to natural freshwater availability.

This is in comparison to agriculture, and industry which account for a combined 90% of human water use (Kundzewicz et al., 2007).

Previous studies by Valipour (2014) indicate that FAO showed that pressure to water resources due to irrigation would be increased by 2050 and that future water allocation decisions must take account of the distribution of agricultural water withdrawals especially those for irrigation, which are strongly seasonal. The value of renewable water resources per capita is decreasing. The increasing population world-wide and rapid urbanization has increased the demand for food therefore pressure on renewable water resources is influenced due to the demand for food and the application of irrigation systems to increase agricultural production (Valipour, 2014).

Previous studies by the WHO and UNICEF (2010) on time to collect water by households indicate that those spending more than half an hour per round trip progressively collect less water, and eventually fail to meet their families' minimum daily drinking-water needs. In addition, the economic costs of having to make multiple trips per day to collect drinking water are enormous. In various countries, notably in Eastern Africa, more than a quarter of the population spends more than half an hour per round trip to collect water. Previous surveys conducted showed that water collection trips of over 30 minutes are most prevalent in Africa and other arid countries outside of Africa (WHO/UNICEF, 2010). Limited access to water in Africa is not mainly a resource issue, but one of poor management, pollution and wastage, and lack of facilities except in Northern and Southern Africa. In most African countries, over 50% of the water supply is wasted or unaccounted for. Therefore Africa is unlikely to reach the drinking water and sanitation MDG target (WHO/UNICEF, 2010).

Access to water was a big challenge to residents of Naivasha. The Naivasha Water and Sanitation Company could only supply 2700m³ out of the 6400m³ demanded by the population in the municipality. The main reason for the deficit in water supply was because of high rate of population growth that the municipality could not supply the required quantities of water. The alternatives to water supply within the municipality were boreholes and rainwater harvesting although these alternatives were not able to adequately meet the demand for the municipality. Some partnerships had been formed between the public sector, private sector, NGOs and research institutions in order to provide alternative water sources that complement the services provided by the water company. These initiatives were evident in peri-urban settlements that were particularly faced with problems of water supply (USAID & WSUP, 2011) such as Mirera and Karagita where a non-profit partnership was working to bring sustainable solutions to water problems in low income areas.

This study aims at contributing to the assessment of the current status of water supply within the municipality and act as a basis of the continuous evaluation of the progress towards achieving the MGD Goal of halving the proportion of population without access to safe drinking water. The objective of this study was to assess the water supply situation in high, middle and low income areas within the municipality.

MATERIALS AND METHODS

The study was carried out in Naivasha municipality. Naivasha has a shallow basin lake, situated 80km northwest of the Kenyan Rift Valley. It lies at an altitude of 1890m between the longitude 36° 20' E and latitude 0° 45' S and covers an area of approximately 100km²

(Republic of Kenya, 2010). The population in Naivasha has rapidly grown from 7000 persons in 1969 to 376,243 in 2009 (Republic of Kenya, 2010). The land use changes since independence have led to rapid growth in population, human settlement, intensive commercial farming, tourism and geothermal production. These have put intense pressure on natural resources in the watershed, which threaten the sustainability of Lake Naivasha. The municipality is in mainly a semi-arid environment with a bi-modal rainfall distribution with long rains between April- June and short rains between October and November. The area receives an average of 600mm of rainfall annually (Mireri, 2005).

Lake Naivasha is a fresh water lake in the Rift Valley and was declared a Ramsar site in 1995. Its watershed is mainly a semi-arid environment with scarce surface and underground water resources. The area around the lake has witnessed major land use transformation following colonization of Kenya. At the beginning of the 1900s the land use in the watershed changed from pastoral economy to large scale white settler farming and since independence in 1963 the area has experienced rapid land subdivision (Mireri, 2005).

The population has increased tremendously around the lake, resulting in a proliferation of unplanned settlements, which lack basic amenities such as water, sanitation and waste disposal programmes (Mireri, 2005). The lack of water in these settlements forces residents to go to the lakeshore for domestic water, laundry and livestock watering (Becht et al., 2006).

The study was a cross-sectional survey targeting households living within the municipality. The survey utilised questionnaires, interviews and observations. The study used both primary and secondary data. Primary data were data were observed and collected directly from first-hand experience using questionnaires, interviews, observation and photography. Secondary data was collected from published articles, books or journals or from other parties. The study captured information on the current status of water supply and sanitation within Naivasha Municipality. This information includes water supply situation in the municipality from the year 2007.

The sample population consisted of population with different income levels, therefore to obtain a homogenous sample with similar characteristics; stratified random sampling was used in this study. The households were stratified by level of income into low, middle and high income bands by mapping out the municipality into the three groups. The National income bands levels were used. A preliminary survey was undertaken to further assist in determining the sampling frame. This sample was then divided among the three classes of households.

Simple random sampling was used to administer questionnaires among the three classes of households stratified by income levels of high, middle and low levels. Randomization was achieved by assigning numbers to households and picking the 5th household to be

interviewed.

According to an economic survey done by the Kenya National Bureau of Statistics (2014) the National monthly income bands was Kshs.0 - 23,672 (0 - 251\$) for the low income, Kshs. 23,672 - 119,999 (\$251 – 1,276\$) for the middle income and Kshs.120,000 (\$1,276) and above belong to the high income. Further, from the preliminary studies, the population followed the pattern shown in Table 1. There are more people in the middle and low income than there are in the high income when using the income bands. Therefore, the sampling frame followed this pattern of population distribution in identification of households to be interviewed.

RESULTS AND DISCUSSION

Water access and demand

Data collected (384 households) through physical observation, questionnaires and photography showed that water supply in Naivasha municipality was a major problem due to the challenges of population growth and poor management of water resources for optimization and conservation.

The data in Figure 1 indicated that the main source of water for the respondents living in high income areas was mostly water purchased from vendors although they were the majority among those who used piped water. The low income groups mostly sourced their water from mobile vendors and communal taps or water kiosks. The main source of water for the middle income group was water piped into their yards.

From the study it was noted purchasing water daily from mobile vendors or water kiosks was costly to the respondents in the middle and low income areas as they ended up spending a considerable amount of their income to buying water. However due to the irregular supply of water, the study found that even respondents in high income areas could sometimes buy water from mobile vendors.

The main source of water for the respondents living in high income areas was mostly water purchased from vendors (31.3%) although they were the majority among those who used piped water, as shown in table 2. The low income groups mostly sourced their water from mobile vendors (30.4%) and communal taps (28.8%) or water kiosks. The main source of water for the middle income group was water piped into their yards (50%) as shown in Table 2.

Table 3 shows there is a significant difference in the main source of water for domestic uses in the three income levels within the municipality. The low income groups mostly purchase water from mobile vendors because they are unable to meet the cost of water connection to their houses and also their areas of residence are not served with the water piping from the

water company.

There have been perennial water problems within the municipality, the reticulation of water systems do not cover all areas of the municipality and this accounts for inability to access piped water for some areas. Most probably, pipes were laid many years back and newer residential areas are coming up for the low income (slums) and the suburbs for the high income. The piped water however was found to be irregular in supply and the high income group also depended on mobile vendors although they were the majority among respondents who indicated that they mostly used piped water. Respondents in Lakeview, a high income residential area, indicated that their piped water supply was regular although they supplemented with drums to store water. The middle income respondents mostly used water that was piped into their yards.

From this study, 63% of the respondents use improved sources of water. In Kenya about 53 percent of the water provided by small-scale providers comes from “improved sources” (UNDP, 2011). The study therefore showed residents in Naivasha use water from improved sources. Furthermore, overall only 57% of households in Kenya use water from sources considered safe (GoK, 2007). The ability of mobile vendors, such as pushcarts and tanker trucks, to obtain water from a variety of sources allows them to supply water in times of shortage. This, however, also introduces an information gap regarding the quality of water sold, as end users have little means of verifying the safety of the water they purchase. Inferior quality pipes used by illegal connections break easily, and initially safe water can thus be contaminated by garbage, other toxic residuals, and impure external water flows (UNDP, 2011).

Per Capita water use

Table 4 indicates that there was no significant difference between the amounts of water used per person per day in the three income levels ($p= 0.829$). Though there is huge intra income variation in water usage, the results indicate that water is truly a basic commodity which, if accessible, income doesn't greatly influence consumption.

This could imply that water use in households is mostly significant depending on the number of household members and the amount of household activities that require water use per day. More washing and cooking within a household will require more water overall in a household.

According to the WHO and UNICEF Joint Monitoring Programme (2000) reasonable access to water is described as a person accessing an average of 20 litres per day. The study shows that the respondents' were able to access water as per the required quantities. However, the number of household members and the

Table 1. Sample size distribution in income levels in Kenya.

	Low Income (0 - 251\$)	Middle income (\$251 – 1,276\$)	High Income (\$ 1,276)	Total
N	322	47	16	385
%	83.63%	12.21%	4.16%	100%

(Source: Survey, 2012)

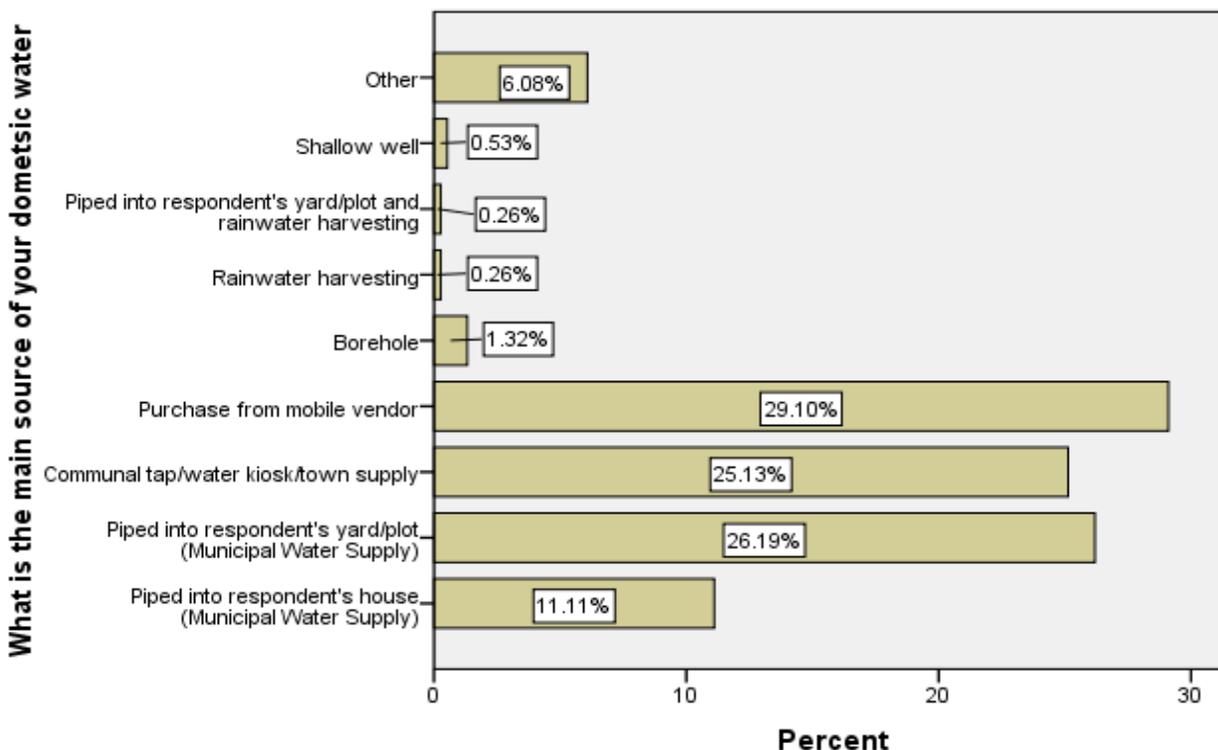


Figure 1. Main Sources of water for domestic use (Source: Survey, 2012).

Table 2. Major water sources in different income groups.

	low income (n=322)	middle income (n= 47)	high income (n=16)
Water piped into respondents' house	9.50%	17.4%	25.00%
Water piped into respondents' yard	23.10%	50.00%	18.80%
Communal tap/water kiosk/town supply	28.80%	8.70%	0.00%
Purchase from mobile vendor	30.40%	19.60%	31.30%
Borehole	1.30%	0.00%	6.30%
Piped into yard and rainwater harvesting	0.30%	2.20%	0.00%
Shallow well	0.30%	2.20%	0.00%
Other sources	6.30%	0.00%	18.80%
Total	100%	100%	100%

(Source: Survey, 2012)

cost of accessing the water brought the challenge of a household's ability to fully meet the water requirements of each member considering the income levels of the three groups.

Cost of water

Table 5 shows that the low income spent 12% of their income on water, the middle income spent 15.7% of their

Table 3. Cross tabulation of Main source of domestic water and level of income.

Main source of domestic water	Level of income			Total
	Low	Middle	High	
Piped into respondent's house(Municipal Water Supply)	30	8	4	42
Piped into respondent's yard/plot(Municipal Water Supply)	73	23	3	99
Communal tap/water kiosk/town supply	91	4	0	95
Purchase from mobile vendor	96	9	5	110
Borehole	4	0	1	5
Rainwater harvesting	0	1	0	1
Piped into respondent's yard/plot and rainwater harvesting	1	0	0	1
Shallow well	1	1	0	2
Other	20	0	3	23

Pearson chi-square = 49.618^a, df=16 p=0.001 (Source: Survey, 2012)

Table 4. Comparison between water quantities used per day.

Level of income	N	Water used per person per day				
		Minimum	Maximum	Mean	Std. Error	Std. Deviation
Low	227	2.50	57.14	20.906	.683	10.284
Middle	33	3.57	59.05	21.505	2.003	11.506
High	9	2.86	60.95	22.934	6.180	18.539

F= 0.187 p= 0.829 (Source: Survey, 2012)

Table 5. Comparison of cost of water per month against monthly income.

	N	Cost of water used per month		Monthly income (KShs.) within group
		Mean	% of income	
Low	148	1592.736	12%	5000- 20,000
middle	14	4713.571	15.7%	20,001- 40,000
high	6	1358.333	2.7%	40,001-above 50,000

(Source: Survey, 2012)

income on water while the high income spent 2.7% of their income on water. The people in the higher income group were able to meet their households' needs because of their ability to pay for water but those in the low and middle income had to find ways of meeting the households needs either by using water minimally or finding alternative ways of conserving the water they got by re-using and by delaying some activities so that they were only done at intervals during the week such as washing clothes and the water re-used for cleaning the floors and toilets.

From Table 5 this expenditure was higher than the recommended range for low and middle income households given that the household had to buy food and pay for shelter among other basic needs. On average, households in Kenya spend 11% of their income on water (UNDP, 2011).

This means that many people who cannot afford water to fully cater for their households' needs are forced to cut down on water usage so as to meet other needs and this compromises the hygiene of the households. This may

lead to spread of water borne and water-washed diseases due to low hygiene. Also, the sanitation situation of households is compromised due to the inadequate amounts of water required to keep sanitation systems clean. However, for the high income group, their percentage household expenditure on water was within the acceptable range and therefore this group may not be affected much. According to Water Governance Project Partners (2009), households should not spend more than 5% of their income on water. In turn the statistics indicate that households would most likely cut on their expenditure on water by purchasing lesser quantity than their daily demand, purchasing water from cheaper sources or engaging in water harvesting. However, the bottom line is a reduction in overall household welfare due to the high cost of water. In Indonesia, a regulation adopted in 2006 prescribes that domestic expenses for the fulfillment of the standard of basic needs for drinking water should not exceed 4% of the income of the user or household (deemed to earn the provincial minimum wage), (Smets, 2009).

In industrialized countries, households with an income equal to the median disposable income generally spend around 1.1% of their income for their water and sanitation bill. Poor households in these industrialized countries spend on average approximately 2.6% of their income (Smets, 2009).

In order to help vulnerable people, public authorities often take measures aiming to reduce water bills to less than 3%. In transition countries and developing countries, the affordability index is generally higher depending whether the country seeks to reduce subsidies for water. Median households often have to spend 2.5% of their income for water, i.e. over twice what is practiced in industrialized countries. Consequently the affordability index of poor households is about three times larger (7.5%) because of the low income of very poor households (Smets, 2009).

CONCLUSION AND RECOMMENDATION

Conclusion

The study established that access to water supply in Naivasha municipality remains a big challenge. The study revealed that only 63% of the residents are able to access improved water sources. The study showed that people in the middle and low income areas spend more than the recommended percentages of their income on water. Regulations should be enacted and adhered to so that domestic expenses for the fulfilment of basic needs for water do not exceed 5% of household income. Public private partnerships should also be encouraged so that access to water can improve.

Kenya's vision of ensuring water and sanitation are available and accessible to all by 2030 still faces challenges of achievement and this means that by extension, Kenya might not attain the MDG target towards halving the proportion of the population without access to safe drinking water and basic sanitation due to challenges of urbanization and rapid population growth. The inadequate access to safe drinking water may result in the worsening of hygiene standards and proliferation of diseases due to water storage and use of alternative water sources.

Recommendation

Current water sources should be used optimally and alternative sources developed and used sustainably so that disparities in expenditure on water can be mitigated. Rainwater harvesting should be encouraged so that water is treated with appropriate chemicals such as chlorine and stored for future use.

The water Company should partner with private stakeholders who can jointly invest in the reticulation of

water to new and unserved areas so that more residents can access water.

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