

FACTORS INFLUENCING AVAILABILITY AND SAFETY OF WATER TO RURAL COMMUNITIES IN KENYA: A CASE OF TIGANIA EAST SUB-COUNTY, MERU COUNTY

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ABSTRACT

The research project was focused on the area of Tigania East Sub-County of Meru County in Kenya. In spite of the progress made in developing water infrastructures in the rural areas in Kenya, the envisaged level of water availability and safety have not been satisfactorily achieved. Water sources are sometimes few with inadequate water and located far from the homesteads of the water users. The water sources are mainly unsafe for consumption. The purpose of this study was to investigate factors influencing availability and safety of water to rural communities in Kenya; a case of Tigania East sub-County. The objectives of the study were to investigate what influences water availability for rural communities of Tigania East sub-County, to establish what influences safety of available water for the rural communities of Tigania East sub-County, to determine the influence of management practices adopted by the water management Board on the availability and safety of water to the rural communities of Tigania East Sub-County and to assess the extent of water scarcity caused by droughts experienced by the rural communities of Tigania East sub-County and the coping strategies they adopt. The study used a descriptive survey design and the theoretical frame work of this study was derived from the Administrative and Contingency theories of management. The target population of the study was 79,389 people of Tigania East Sub-County, who make 16,325 households, from where a sample size of 246 respondents was picked. The sample was picked using the stratified random sampling method. Questionnaires and interview

schedules were used to collect data and 25 respondents were used for pilot testing before the commencement of the study and any detected errors in the data collection instruments were corrected. Data analysis was done using Statistical Package for Social Sciences and descriptive statistics computed. The data was presented using Tables and percentages. The study showed that 24.4% of the people accessed piped water and river water. The study found that the shortage of water is extreme. In the area of study, it was concluded that water scarcity is caused by droughts experienced by the rural communities of Tigania East sub-County. It was also concluded that management practices adopted by the water management Board influence the availability and safety of water to the rural communities of Tigania East Sub-County significantly. It was also concluded that the pollution of water sources affects the safety of the water available to the rural communities of Tigania East sub-County positively. It was also concluded that distances to water sources affects the availability of water to the rural communities of Tigania East sub-County positively. It is recommended that stakeholders such as the government, NGOs, community self-help group and faith based organization should come up with strategies on how to improve water access to the rural community. The results help staff of the Ministry of Water and Irrigation to formulate strategies to address the water situation in Tigania East Sub-County.

Key Words: *safety of water, rural communities, Kenya, Tigania East Sub-county, Meru County*

INTRODUCTION

Water is a basic need and human right of people. Water is needed for domestic, irrigation and sanitation purposes. Water is also needed for other uses such as livestock rearing, gardening, food processing and even aquaculture according to Soussan (2003). Availability of adequate and safe drinking water is essential for both individual and population health as well as for quality of life. Bartram and Cairncross, (2010), reported that improvement in water supply and hygiene has shown substantial influence on reduced water borne diseases such as diarrhoea. The study area is located on the leeward side of Nyambene Hills and it is only the high areas that receive adequate rainfall of about 1800mm, while the low lying areas receive about 380mm per annum. Droughts are frequent in the study area and they often cause severe water scarcity.

In the world including Kenya, people are facing the problems of water scarcity. According to WHO (2009) report, the scarcity of water has forced people to use unsafe water for drinking and other domestic purposes. About 1.7 billion people in developing countries have no access to safe drinking water as reported by UNICEF, (2013). As a result, about 50% of populations in the developing countries suffer from water-borne diseases such as diarrhoea, cholera, ascaris and hookworms. When people do not have access to safe water supply, there will be higher risk to their health condition. Diarrhoea infection alone is responsible for 1.8 million deaths a year worldwide, of which 90% are children under the age of five according to WSSCC, (2010) report.

A number of reports and policy instruments have given estimates of current availability levels to safe water in Kenya. It is estimated that more than 80 per cent of Kenya's population live in the rural areas. According to the WHO/UNICEF Joint Monitoring Programme (2012), only 52 per cent of the population living in rural Kenya had access to improved drinking water sources in 2016. The national average is 59%. The draft National Water Policy (NWP) 2012 puts current rural coverage at below 50 per cent. The African Ministers Council on Water (AMCOW) Country Status Overviews 2- Regional Synthesis report for 2011 puts coverage in Kenya in 2016 at only 42%.

To emphasize the importance of availability of safe water, The Bill of Rights under article 43 of the Constitution of Kenya (COK) 2010 states that access to safe water and safe sanitation is a right. The draft NWP 2012 further aligns the sector with the new Constitution based on the guiding principles - right to water with pro-poor orientation, participatory approach to water development and management and good governance practices at all levels. The policy objectives of the draft further include "progressively achieving universal rights to water supply and sanitation for all by 2030 in the rural and urban areas" (NWP 2012).

Water scarcity has been a major issue in Kenya for decades. The scarcity has been caused mainly by years of recurrent droughts, poor management of water supplies, particularly in operation and maintenance of water supplies. The other causes of water scarcity are, contamination of the available water and a sharp increase in water demand resulting from relatively high population

growth. Poor management practices of the existing water schemes have negatively affected the availability and quality of water supplied to their consumers. This in turn affects the benefits expected to accrue the consumers. Good water scheme management practices ensures satisfactory water supply systems which depend on social acceptability, social viability and technical and environmental sustainability.

Safe drinking water quality significantly improves the quality of life which leads to improved human well-being. Water borne diseases as mentioned earlier, are related to poor water quality or unsafe water. To control these diseases, a sufficient amount of safe drinking water is important. The United Nations General Assembly has declared access to safe drinking water a fundamental human right. A number of criteria have been used to specify the content of the right: availability, quality, acceptability, accessibility and affordability. In spite of efforts to increase access to water, many rural water supplies constructed to completion, have either stopped operating or are not operating optimally. This has resulted in loss of service to populations living in the rural areas of Kenya. Many of the dysfunctional water schemes were operated and managed by the Ministry of Water personnel or by community based organizations such as Community Water and Sanitation (WASH) Committees, Water User Associations or Women groups, NWRMS, (2006) reports.

To improve access to adequate and safe water to its population, the Kenya government enacted the Water Act 2002 which brought the water sector reforms. The water sector reforms in Kenya are premised on the National Policy on Water Resources Management and Development of 1999 and the Water Act 2002. These instruments set up institutional and regulatory framework embracing broader principles of decentralization, participation, autonomy, sustainability and efficiency in service delivery.

It is with this background that eight (8) water services boards were established across Kenya. Tana Water Services Board (TWSB) in whose jurisdiction the study area lies is one of them. Pursuant to Section 53 of the Water Act 2002, the Tana Water Services Board is responsible for construction of water infrastructure and the efficient and economical provision of water services within its area of jurisdiction, which covers the Counties of Embu, Kirinyaga, Meru, Murang'a, Nyeri and Tharaka Nithi.

TWSB is therefore mandated with the construction of water infrastructure in the study area as well as provide water services of these completed infrastructures through appointed Water Service Providers (WSPs). The WSPs are licensed by TWSB to manage water services on its behalf within designated areas with the participation of the local beneficiary communities. The WSP for the study area is Imetha Water and Sanitation Company.

This study was therefore undertaken to investigate factors that influence water availability to the rural communities of Tigania East sub-County and establish factors that influence safety of the available water to the rural communities of Tigania East Sub-County. It was also to determine

the influence of management practices adopted by management Board of Imetha Water and Sanitation Company on the availability and safety of water to the rural communities of Tigania East sub-County and assess the extent of water scarcity caused by droughts experienced by the rural communities of Tigania East sub-County and the coping strategies they adopt.

The study area was Tigania East Sub-County. Tigania East Sub-County is one of the sub-Counties that make up Meru County. It lies on the leeward side of Nyambene Hills. Its altitude ranges from 2,145m above sea level in the higher regions of Nyambene Hills to 600m in the lower parts which cover the greatest land area, which is 3/4 of total area. The total area is about 120 km². These low lying areas are designated as the Northern Grazing Areas (NGA) and are characterized by low and erratic rainfall, according to the International Medical Corps (2012) report. The soils are predominantly volcanic clay loams with patches of rock and black cotton soils. International Medical Corps (2012) report, noted that, rainfall amounts range from 380mm per annum in the lower areas to 2500mm per annum in the higher areas. Its spatial distribution is highly dependent on elevation, with the high altitude areas receiving the most amounts compared to the low-lying areas. It also noted that rainfall is bimodal with long rains experienced from mid-March to May and the short rains from mid-October to late November. The short rains are more reliable. The higher zones are characterized by coffee, tea and dairy farming, while the low lying areas are generally grazing areas. Thus, land potential increases with elevation and high income generating crops do well in higher areas, whereas livestock and subsistence crops are predominant at lower elevations.

Parts of Tigania East Sub-County have intermittently been getting piped water from Tigania Water Supply Scheme. Tigania Water Supply Scheme has been in existence since 1970. However, in the years running upto 2017, only about 40% of the community members were getting its services. Most of the infrastructure has been dilapidated, vandalized and poorly managed by the Ministry of Water staff assigned to manage the water supply. The beneficiary community has resulted to fetching water from sources whose water quality was not safe. Some of those sources are set down in deep valleys most of them holding seasonal streams while others are hand-dug wells. So the task of fetching water has been onerous and tiring besides being time consuming. Water has not always been enough in homesteads and this has negatively affected the beneficiaries economically, socially and even health wise.

STATEMENT OF THE PROBLEM

Water is an essential commodity for life. People will always go to great lengths to access it so that they can be able to live. People's lives are affected by the distances to water sources, the quality and quantity of water obtained. In the rural areas without piped water, people prioritize the activity of fetching water. They usually abandon gainful economic activities to first get water into their homesteads. The activity of fetching water may take several minutes to several hours depending on how far the water source is located. In most communities, women and the girl child are the ones usually tasked with fetching water. This may negatively affect the

development and improvement of their livelihoods. Lack of water sources with adequate and safe water is a threat to the homesteads hygiene and the people's health as they may contract water borne diseases. Diseases in families affect their economic status as the cost of disease treatment and medical care take a substantial amount of their households' income. This study was therefore undertaken to investigate factors that influence water availability to the rural communities of Tigania East sub-County and establish factors that influence safety of the available water to the rural communities of Tigania East Sub-County. It was also to determine the influence of the management practices adopted by the management Board of Imetha Water and Sanitation Company on the availability and safety of water to the rural communities of Tigania East Sub-County and assess the extent of water scarcity caused by the droughts experienced by the rural communities of Tigania East sub-County and the coping strategies they adopt.

GENERAL OBJECTIVE

The purpose of this study was to investigate the factors influencing availability and safety of water to rural communities in Kenya: a case of Tigania East sub-County in Meru County.

SPECIFIC OBJECTIVES

1. To investigate the influence of water availability on the rural communities of Tigania East sub-County.
2. To establish the influence of safety of water on health for the rural communities of Tigania East sub-County.
3. To determine the influence of the management practices adopted by the water management Board on the availability and safety of water to the rural communities of Tigania East Sub-County.
4. To assess the extent of water scarcity caused by the droughts experienced by the rural communities of Tigania East sub-County and the coping strategies adopted.

THEORETICAL FRAMEWORK OF THE STUDY

Theories are used to describe, forecast and comprehend something and in some cases to question and add existing information by using critical suppositions. The theoretical framework is an anatomy, shape or form that can support a theory in a research study according to Swanso, (2013). In this study the researcher will adopt two theories. These are the Contingency Theory of Management and the Administrative Theory of Management.

The Contingency Theory of Management

This study is anchored on the Contingency theory of management, also known as situational approach. The Contingency theory is based on the idea that there is no one universally applicable set of management principles by which to manage organizations. Organizations are individually different, face different situations and require different ways of managing, according to Gakuu

and Kidombo, (2010). Organizational systems are inter-related with the environment. Hellriegel and Slocum, (1973) suggests that different environments require different organizational relationships for optimum effectiveness, taking into consideration various social, legal, political, technical and economic factors.

Before the enactment of the water sector reforms (Water Act, 2002), the Ministry of Water did all the important functions concerning water. The Ministry was responsible for setting water policies, constructing water infrastructures and providing water services. In carrying out these functions, it was found that it was not as effective as desired (NWSS, 2005).

The main thrust of the water sector reforms was to separate water resources management and development of infrastructure from water services delivery (NWRMS, 2006). The Ministry of Water was left with the roles of policy formulation, infrastructure development and monitoring. The provision of water services was left to Water Service Providers under license and monitoring by the respective regional Water Service Boards (NWRMS, 2006).

Water Service Providers are the organizations charged with the responsibility of providing adequate and safe water services to various localities in the Country. In management of these WSPs, Contingency theory is applied. This is because, in spite of the Ministry of Water giving broad policy guidelines, each WSP is supposed to operate under the obtaining environment it is in, so long as, how they propose to manage the water scheme is endorsed by the respective Water Service Board and ratified by WASREB.

Administrative Theory of Management

The Administrative Management Theory attempts to find a rational way to design an organization as a whole. The theory generally calls for a formalized administrative structure, a clear division of labour, and delegation of power and authority to administrators relevant to their areas of responsibilities. The Administrative management theory involves many important concepts. The first concept is the formalized administrative structure. According to this theory, an organization should be designed using a formalized structure with clear lines of authority from the top down. This is a hierarchical structure. The second one is Division of labour. In this concept there is a clear division of labour between the organization's departments. Each department is responsible for a particular aspect of the organization's activities towards the achievement of organizational goals.

The third concept is the Delegation of power and authority. In this concept there is the delegation of power and authority to administrators commensurate with their responsibilities in the organization. The administrative theory is given by Henri Fayol (1841-1925), who believed that more emphasis should be laid on organizational management and the human and behavioural factors in the management. Thus, here the main focus is on how the management of the organization is structured and how well the individuals therein are organized to accomplish the

tasks given to them. The administrative theory aims at improving the efficiency of management first so that the processes can be standardized and then moves to the operational level where the individual workers are made to learn the changes and implement them in their routine jobs and follows the top-down approach. In this study the researcher will investigate the management practices of the Board of management of Tigania Water Scheme and determine how it compares to the two theories of Contingency management theory and Administrative theory of management.

KNOWLEDGE GAP

Water is a precious resource and vital for life. Access to a safe and affordable supply of drinking water is universally recognized as a basic human need for the present generation and a pre-condition for the development and care of the next, according to UNEP, (2014) report. Water is also a fundamental economic resource on which people's livelihoods depend. In addition to domestic water use, households use water for productive activities such as farming and livestock rearing in rural areas, or horticulture and home-based microenterprises in urban settlements. Water shortage, poor quality water, or unreliable supply has profound effects on people's well-being. The United Nations classifies Kenya as a chronically water scarce country on the basis of having one of the lowest natural water replenishment rates, at 647 metres cubed per capita per annum which is far below the 1,000 metres cubed per capita per annum recommended. Estimates of water supply in the country indicate that only about 56 per cent of the population has access to safe water according to World Bank, (2010) report.

Tigania East Sub-County has scarcity of water as it is located on the leeward side of Nyambene Hills. It is only the higher parts that experience adequate rain during the rainy seasons. The lower parts are arid as they receive relatively lower rainfall amounts as reported by International Medical Corps Report (2012). All these affect the availability and safety of water. With low annual rainfall and pollution of water sources by herbicides, pesticides and fertilizers from agricultural farms, water availability and safety is adversely affected. The management of the water supply serving the Sub-County has also had an effect on the availability and safety of water here. Water availability and safety has also been affected by the now almost regular droughts which bring about water scarcity.

The information on the availability and safety of water in Tigania East sub-County is scant. Several studies have been carried out here but none has concentrated on the issue of water availability and its safety. One study was carried out by Mr. Saiyana Lembara of National Drought Management Authority and Dr. Joseph Mathooka of Food and Agricultural Organization (FAO) in 2013. Their study was titled, "Long rains food security assessment". Their study found out that distances to water sources for rural communities were between 0.5 km to 10 km and for livestock as an average of 6 km. Their study did not assess the safety of the available water. Another study in Muthara area of Tigania East Sub-County was done by Mr. Paul Kennedy, a Peace Corp Volunteer from Michigan Technological University in 2006. The

study was titled, “An analysis of the relationship between water accessibility, use and health in Muthara, in Meru County in Kenya”. This may have caused changes to distances to water sources and the safety of the available water to warrant a study to be carried out. It is also worth noting that their studies were not solely focused on the water issues alone. Mr. Paul Kennedy’s study concentrated on Muthara area only.

RESEARCH METHODOLOGY

Research Design

The study used a descriptive survey design. According to Mugenda and Mugenda (2003), a descriptive research design is used when the problem is well defined and the researcher knows something about the problem; descriptive survey design was appropriate because it involves collecting data in order to answer questions on the status of the subjects of the study.

Target Population

The target population for this study was the entire population of Tigania East Sub-County, which is 79,389 people according to Kenya Census (2009).

Sample Size and Sampling Procedure

A stratified random sampling procedure was used in this study. A stratified random sample is a population sample that requires the population to be divided into smaller groups called strata. Tigania East Sub-County is constituted of nine wards. Each ward has several sub-wards. Of the nine wards, four are randomly chosen for this study. In getting the sample for this study, stratified random sampling ensures that a population from one sub-ward from each randomly chosen ward is represented. The study area constituted nine administrative wards which include, Muthara, Buuri, Thubuku, Ngaremara, Mula, Gambela, Karama, Baranga and Antuanduru. Four wards were randomly chosen for this study. Each ward constitutes several sub-wards and one sub-ward was randomly chosen from eachward. A sample size of 246 people was obtained from 2461 households of Tigania East Sub-County.

Data Collection Procedure

Data was collected using questionnaires and interview schedule method. The tools were tested to determine their suitability to the respondents. The questionnaires were both structured and unstructured questions. One research assistant was recruited to assist in data collection. The research assistant recruited from the local area was briefed on the process and procedures for administering and recording data. He was also briefed on ethical issues prior to embarking on the research work. Prior information was passed to all research participants on the interview dates, locations and times. Every effort was made to ensure that the research participants were not inconvenienced and time lines were adhered to. The researcher obtained consent from all the

relevant institutions such as the local administration and the local Water Service Provider. The households were purposively sampled, as the technique allows researchers to use cases that have the required information with respect to the objectives of the study (Mugenda and Mugenda, 2003).

Data Collection Instruments

Questionnaires were the main data collection instruments that were used to collect data in this study. The questionnaire had both structured and unstructured questions. The structured questions limited the respondents to give the information the researcher was interested in. The questionnaires were cheap to administer as the only cost were associated with printing, designing the questionnaires, the postage of the questionnaires or electronic distribution. Questionnaires also offered some confidentiality to the respondents. The questionnaires were organized according to the objectives of the study. Therefore, the research instruments used in data collection were questionnaires and interview schedules. The questionnaires were used to collect data from individuals identified from the chosen households, while the interview schedule was used to collect data from the members of the Board of management of the Water Scheme. A drop and pick method was used where the questionnaires were dropped on day one and collected in the next.

Pilot Testing of the Instruments

Pilot testing of research instruments is the checking of the suitability of the questionnaires and interview guide. The pilot group was acquired through random sampling. Mugenda and Mugenda, (2003) suggest that the piloting sample should be 10% of the study sample depending on sample size. Piloting helps in revealing questions that are vague and allows for their review. The piloting also helps the researcher to check on whether the variables collected could easily be processed and analyzed. In this study, 10% of 246 respondents were 25 respondents. For the piloting exercise for this study, 20 respondents were randomly chosen from the neighbouring County of Tigania West Sub-County. After the piloting exercise, the questions in the questionnaire were assessed and those found not to be clear were adjusted for clarity.

Validity of the Instruments

Validity is the degree to which the results obtained from the analysis of the data actually represent the variables of the study. Dowling, (2004), refers to validity in research as to how accurately a study answers the study questions or the strength of the study conclusions. Validity helps the researcher to confirm that the questionnaire items give the desired outcomes. When the research design addresses the research questions and set objectives, then the research instruments can be said to be valid. Validity in this study was ensured through stratified random sampling that made the residents of Tigania East Sub-County well represented. The research instruments were also reviewed with the researcher's supervisor.

Reliability of the Instruments

In this study, the reliability of the instruments was determined by administering the questionnaire to the same group of respondents at two separate times. This was done after a time lapse of one week. This was conducted with 25 respondents who were not part of the main study. Reliability of the instruments was computed using Cronbach alpha coefficient formula. A correlation of 0.8 was obtained, meaning the instruments were reliable and measurable.

Reliability Analysis

In this study, construct reliability was determined using Cronbach alpha coefficients that test internal consistency of items on a scale. The results of the reliability analysis are presented in Table 1.

Table 1: Reliability Analysis

Scale	Cronbach's Alpha
Water availability	0.836
Water safety	0.912
Management practices	0.889
Water scarcity	0.868

Table 1 shows water safety had the highest reliability ($\alpha= 0.912$), followed by management practices on water availability and safety ($\alpha=0.889$), then water scarcity ($\alpha=0.868$), while the least reliable was water availability ($\alpha=0.836$). This illustrates that all the four variables were reliable as their reliability values exceeded the prescribed threshold of 0.8. All variables are considered reliable if the results show that the Cronbach Alpha, associated with the variables of the study are above 0.80 threshold as recommended by Leach (2016) where it is asserted that Cronbach Alpha should be in excess of 0.80 for the measurement intervals.

Data Analysis Technique

Data analysis is the process of collecting, modeling and transforming data in order to highlight useful information, suggesting conclusions and supporting decision making according to Sharma, (2005). Data analysis involves examining what has been collected in a survey or experiment and making decisions and inferences. The findings of data analysis are presented, analyzed and discussed in conjunction with the objectives of the study. According to Esternberg, (2002), qualitative data analysis is a process of bringing order, structure and meaning to mass of collected data. In this study, the qualitative data gathered from the questionnaires and interview schedules were coded and analysed. Data from the field was first edited. Every questionnaire was checked to ensure it was complete and correctly filled. This was followed by coding of all data so that it could be analysed with the aid of the Statistical Package for Social Sciences Version 21 computer programme. After data collection, all returned questionnaires were numbered,

categorized and data coded. A code book containing all the variables derived from the research objectives and research questions of the study as presented in the questionnaire was developed. Data was analyzed using descriptive statistics including tables, percentages and other measures of central tendency such as the mean, mode and median.

Inferential data analysis was done using Pearson correlation analysis. Pearson correlation coefficient was used to determine the strength and the direction of the relationship between the dependent variable and the independent variable. The analysis using Pearson's product moment correlation was based on the assumption that the data is normally distributed and also because the variables are continuous.

RESEARCH FINDINGS

Water Availability

The study sought to investigate the effects of distances to water sources on the availability of water to the rural communities of Tigania East sub-County. The study showed that most of the people access piped water and river water and that majority of the residents take little time to fetch water from other sources. These findings are in line with International Medical Corps Report (2012) which argues that short rains are more reliable and that rains replenish the various water sources, such as ground water, water pans, rivers and streams.

The study also found that most of Tigania East sub-County residents walk for short distances to reach water sources. This conforms to International Medical Corps Report (2012) which reports that most sources, including water wells, water pans, rivers and some streams dry up during drought periods making the community members to walk long distances in search of water.

Water Safety

The study further sought to establish the effects of pollution of water sources on the safety of the water available to the rural communities of Tigania East sub-County. The study found that the shortage of water is extreme and that the shortage of water is extreme in Tigania East sub-County. The study further found that pipe bursts are repaired immediately and that there is a likelihood of water sources being polluted. These findings correlate with Lall (2008) who suggested that the impact of water shortages are particularly acute in the developing world, where rising populations and climate change are expected to cause severe water shortages for one-third of the population in this century.

The study revealed that water pollution cause water shortage and that water pollution cause incidences of water borne diseases. The study reveals that water sources in Tigania East sub-County are not tested for water quality regularly. The study also revealed that management regularly monitors the quality of the water they supply to their consumers. These concur with Water Act 2002 which claims that the Water Services Boards are responsible for asset

management that is, for the development and rehabilitation of water and sewerage facilities and for investment planning and implementation.

Management Practices on Water Availability and Safety

The study further sought to determine the influence of the management practices adopted by the water management Board on the availability and safety of water to the rural communities of Tigania East Sub-County. These conform to Rijsberman (2004) who reported that a broad agreement does exist that there will be significantly increasing water scarcity that will turn water into a key, or the key, limiting factor in food production and livelihoods generation for poor people virtually throughout rural Asia and most of Africa.

The findings showed that the water charges are not affordable to most of the residents of Tigania East Sub-County and that Imetha Water and Sanitation Company in Tigania East Sub-County involve the community in their stakeholder meetings. The study also revealed that Imetha Water and Sanitation Company hold stakeholder meetings regularly. The study revealed that the management provides water through water kiosks for those who cannot afford individual connections to make water accessible, that they make sure source of piped water has adequate water all the year round and that Imetha Water and Sanitation Company have a current Strategic Plan and that they regularly train their water staff on operation and maintenance of the Water Scheme. This is in line with Gleick (2004) who noted that lack of access to piped water supply sources leads to high rates of sickness and death among young children from preventable diseases, and arguably qualifies among the 20th century's greatest development failures.

Water Scarcity

The study sought to assess the extent of water scarcity caused by droughts experienced by the rural communities of Tigania East sub-County and the coping strategies they adopt. The study indicated that droughts occur frequently and that majority of Tigania East sub-County residents use water for irrigation. These concur with World Bank report (2010) which noted that there are about 40 million people living in Kenya, of which about 17 million (43 percent) do not have access to clean water.

Pearson's Product Moment Correlation

To quantify the strength of the relationship between the variables, the study used Karl Pearson's coefficient of correlation. The Pearson product-moment correlation coefficient (or Pearson correlation coefficient) is a measure of the strength of a linear association between two variables and is denoted by r .

Table 2: Pearson’s Product Moment Correlation Coefficients

	Improved Access to Water	Water availability	Water safety	Management practices	Water scarcity
Improved Access To Water	1				
Water availability	.611	1			
Water safety	.713	.124	1		
Management practices	.631	.361	.001	1	
Water scarcity	.526	.661	.321	.621	1

Results in Table 2 reveal that the correlation between water availability and improved access to water is positive and significant (R=0.611, p value=.0016). This implies that an increase in improved access to water is associated with increase in water availability and a decrease in improved access to water is associated with a decrease in water availability.

In addition, the study reveals that the correlation between water safety and improved access to water is positive and significant (R=0.713, p value=.0011). This implies that an increase in water safety is associated with an increase in improved access to water and a decrease in improved access to water is associated with a decline in water safety.

Further, the study revealed that the correlation between management practices and improved access to water is significant (R=0.631, p value=.0018). This implies that an increase in good management practices is associated with an increase in improved access to water and a decrease good management practices is associated with an decrease in improved access to water.

Finally the study established that the correlation between water scarcity and improved access to water is positive and significant (R=0.526, p value=0. .0021). This implies that an increase in water scarcity is associated with and decrease in improved access to water and a decrease water scarcity is associated with an increase in improved access to water.

CONCLUSIONS

The following conclusions were made from the study; it was concluded that distances to water sources affects the availability of water to the rural communities of Tigania East sub-County positively. The study deduced most people access piped water and river water. The study also found that that most of Tigania East sub-County residents walk for short distances to reach water sources.

It was also concluded that pollution of water sources affects the safety of the water available to the rural communities of Tigania East sub-County positively. It was deduced that the shortage of

water is extreme in Tigania East sub-County. The study also revealed that water pollution cause water shortage and that water pollution cause incidences of water borne diseases. The study also revealed that management regularly monitors the quality of the water they supply to their consumers.

It was also concluded that management practices adopted by the water management Board influence the availability and safety of water to the rural communities of Tigania East Sub-County significantly. The findings showed that the water charges are not affordable to most of the residents of Tigania East Sub-County and that Imetha Water and Sanitation Company in Tigania East Sub-County involve the community in their stakeholders meetings. The study also revealed that the management provides water through water kiosks for those who cannot afford individual connections to make water affordable and that they make sure source of piped water has adequate water all the year round.

Finally, it was concluded that water scarcity is caused by droughts experienced by the rural communities of Tigania East sub-County. It was found that droughts occur frequently and that majority of the Tigania East sub-County residents use water for irrigation.

RECOMMENDATIONS

The following recommendations were made from the study. It is recommended that decentralization and privatization of water can promote competition and ensure broader access to water resources. In relation to government effectiveness and political stability, further research should explore access to improved water and sanitation among refugee populations in affected nations. Also, it is important to explore the development of these resources in post-conflict nations, which often face significant problems of post-conflict fragility including physical destruction, environmental degradation, social trauma, severely limited productive capacity and service provision, and general lack of trust, oversight, and accountability.

It is recommended that the community members should be engaged actively during the planning of how to overcome water shortages. Engagement of community members needs to go beyond mere site selection and contribution of cash and provision of labour, but input into the design and planning for the project. Community members should be given priority in the selection of locally appropriate and acceptable technologies other than imposing these on them. In cases where locally appropriate technologies are not feasible the technologies should be blended so as to promote ownership and acceptability by the communities.

Handing over of the water supply projects should not be abrupt but rather should be gradual and may stretch to at least 1 year following implementation of a new project. This will allow implementers enough time for detecting corrective actions including mainstreaming the management committees, the quality and quantity of the water from the projects.

It is also recommended that stakeholders such as the government, NGOs, community self-help groups and faith based organization should come up with strategies on how to improve water access to the rural communities. This strategy may include construction of more earth dams, dig more bore holes, piping water to each home, construction of communal water tanks and storing rain water in tanks.

The study further recommends that the communities should come up with their own initiatives like water conservation, tree planting and initiating fund mobilization to build more community dams and also purchase water tanks to harvest rain water.

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