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EVALUATION OF WATER ACCESSIBILITY, DISTRIBUTION, WATER USE POLICIES AND MANAGEMENT IN KENYA

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Abstract

Water is life; every living creature needs water to continue living. Recently, access to clean water for sanitation and consumption uses is a basic right for sustainable livelihood. Kenya has less than 1000 m3 per capita of renewable supplies of freshwater making it a water-scarce country as per the United Nations classification. In Kenya, climate change, and a high population growth rate has led to less availability, accessibility, quality, and quantity of water to meet human needs. Inadequate water poses a greater risk to food production, human health, energy production, economic development, and poverty reduction thus jeopardizing the achievement of the Sustainable Development Goals. The severe water crisis in Kenya has been due to some causes like drought, deforestation, floods, land pressure from population growth, water contamination, lack of proper water management measures, and ineffective water policies. Kenya continues to face challenges concerning the allocation, distribution, and management of its water resources to satisfy sectoral demands. This paper uses secondary data to evaluate the state of water accessibility and availability of water, economic analysis of water, water management policies, and problems facing water management in Kenya, and to provide recommendations to identified problems.

Keywords: Kenya, Water policies, Water costs, Water management, Water

1.INTRODUCTION

Kenya has a landmass of approximately 592,000 km^2 of which 80% is semi-arid and only 20% is arable. Kenya, being an agricultural country, relies heavily on water as a basic factor to enhance her development for her expanding economy. The renewable freshwater sources have an annual quantity estimate of 30.7 billion m^3. The recommended global water supply per capita is 1,000 m^3 /person per year but Kenya has approximately 696 m^3 /person per year, which makes her a water-scarce country. It also shows that there is a 2.3 m^3 water consumption difference since Kenyans consume about 33 billion m^3 of water (Aquastat, 2016). The average per capita water consumption

in the world is around 800 m^3 per year. Countries with less than 1000m^3 per capita water consumption are considered to water-scarce thus qualifying Kenya and most countries in Africa to have water scarcity. 1.4 billion people, which corresponds to approximately 20% of the world's population, lack sufficient drinking water and 2.3 billion people have difficulty accessing clean water and sanitation. Some estimates suggest that more than 3 billion people will face water scarcity by 2025. The challenges resulting from water scarcity are evident in urban informal settlements and rural areas where residents are unable to access piped water. The demand for water in various sectors in the country; industry, wildlife, infrastructure, hydropower, domestic use, and agriculture for activities like irrigation that cause water menace in Kenya. Within the past five years, water coverage has only indicated a mere 4% per year increase margin even though in 2015, the National Water Service Strategy (NWSS) had targeted to achieve 80% coverage. The current countrywide water coverage is at 55% (Kenya's National Water Master Plan 2015).

1.1 Water Accessibility and Availability Concerning Population Growth in Kenya

Access to clean and safe water is a basic human right and everyone has a right to a clean source of water. The third target under Millennium Development Goal (MDG) on environmental sustainability, aims at improving access to sustainable water and better sanitation. An individual is required to have access to water if he/she can access at least 20 liters of water within a radius of one kilometer (WHO, 2000). Between 2010 and 2015, access to sanitization and water services slightly increased in the country. In 2015, about 63% of Kenyans that is 57% in rural areas and 82% in urban areas had an access to improved drinking water as compared to 2010, which had 60% that is 53% in rural areas and 83% in urban areas. Improvement in water accessibility has been driven by the increase in access to piped water in rural areas. However, the proportion of the urban population accessing piped water fell between 2010 and 2015 from 47 percent to 45 percent (WHO/UNICEF 2015).

UNICEF and World Health Organization discovered that only 59% of the Kenya population has access to basic water services (WHO/UNICEF 2015). . The poor Kenyans in cities have the majority of the population living in informal settlements where they only access polluted water, exposing them to waterborne diseases like cholera deteriorating their health. By the year 2025, it is approximated that Kenya will have 235 m^3 per year water availability, two-thirds of the current availability caused by the continued increase in population. Kenya might face severe economic water scarcity beyond 2025 because of rapid population growth (The WASH Joint Monitoring Programme Report 2019). Surface water and groundwater are the main sources of the piped water in Kenya. The surface water sources include reservoirs, large dams, and rivers. The reservoirs have a storage capacity that can regulate river runoffs and pumping off take facilities in small dams, rivers, and some lakes. Kenya has two types of rivers that are the seasonal rivers in arid and semi-arid areas and perennial rivers found in coastal, western, and central parts of the country. River flooding is also common during the long rains, however, the metrological department in Kenya has been attempting to study and record floods as they happen to prevent future effects of such floods (Mutui et al. 2016).

The groundwater in Kenya is found in deep aquifers that are up to 300 meters. Nairobi area is a good example of such an aquifer and it is the largest even though the aquifers in all regions of

Kenya are 150 meters deep on average. The most important determinant of the groundwater is the Kenya hydro-geological units. The major challenge facing the country is the lack of funds for the construction and maintenance of strong water piping systems causing more than half of the population to lack access to piped water. Those who have access to piped water get contaminated water since the pipes are poorly constructed or are vandalized (Maino, 2011).

Table1:Percentage of water usage in different sectors in Kenya

Sectors	**Percentage of water used**
Agriculture	80%
Service industries	12%
Mining and quarrying, manufacturing, constructions, and energy	8%
Total	100%

Source: United Nations (2017) Kenya; SDG 6 Data

The main water catchment basin areas in Kenya are Lake Victoria, Rift Valley, Athi River, Tana River, and Ewaso Ngi'ro North Basins as presented in figure 1.

Figure 1**:** Kenya map showing major catchment areas from the Ministry of Water and Irrigation

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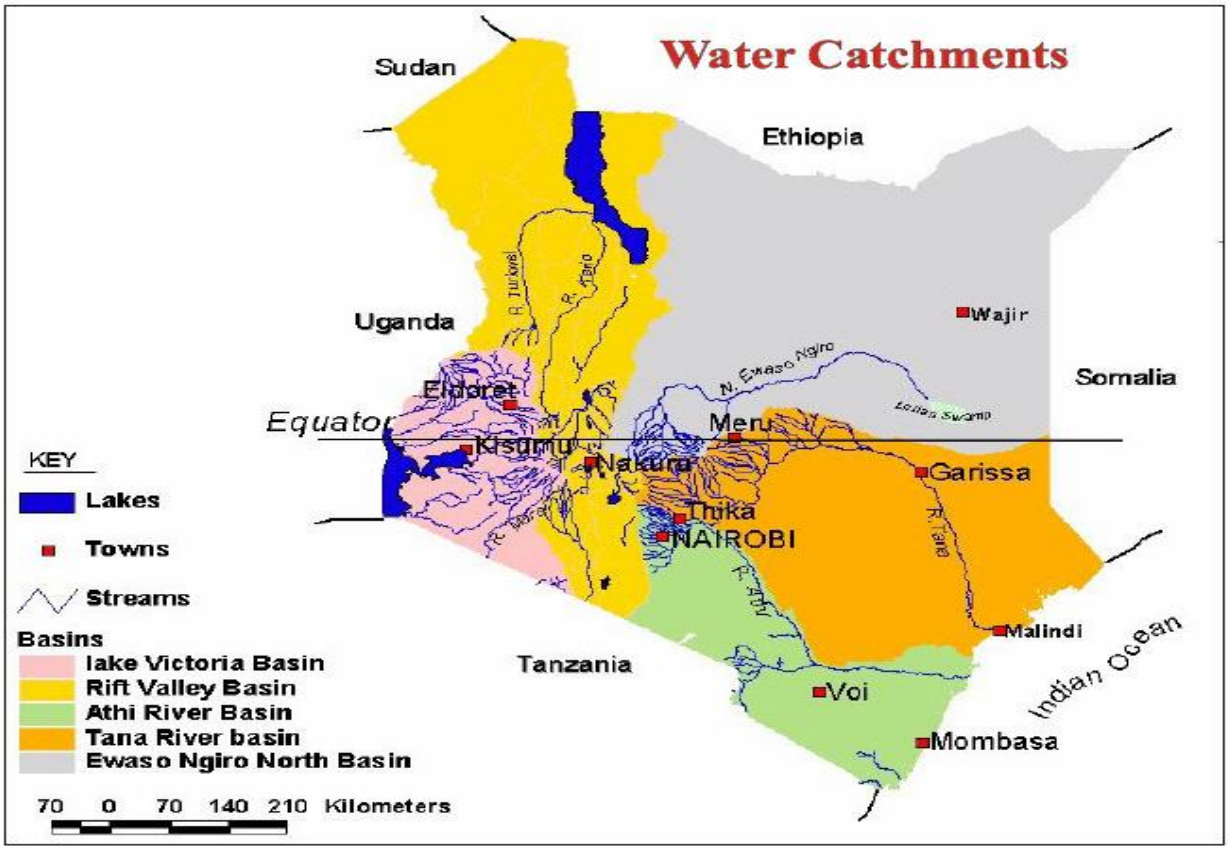


2.0 Methodology

The study used a descriptive survey design. This design enables a researcher to conclude one transitory data collection to extrapolating what might happen again in a similar circumstance. Descriptive design is chosen since it focuses on data instead of theory. This study used secondary data sources. Secondary data is hard to manipulate as opposed to primary data that is prone to manipulation by the researcher. Data was collected from journals, articles, and water agencies like the Ministry of Water and Irrigation, Water Services Regulatory Board (WASREB), Water Resources Management Authority (WRMA), and Water Services Trust Fund to the Water Sector Trust Fund (WSTF). The content analysis method analyzed qualitative data and descriptive statistics like frequency and percentage analyzed quantitative data.

3. FINDINGS AND DISCUSSIONS

3.1 Sources of Household Drinking Water

Table 1 shows the sources of Household Water drinking Kenya in Kenya. According to NEMA (2010). Mount Elgon, Cherengani Hills, Mount Kenya, Mau Forest Complex, and Aberdare range are the five water towers where most of Kenya's water comes from. They are the largest mountain forests and the sources of main rivers in Kenya. The majority of households in Kenya (88.2%) urban centers and (59.1%) rural centers obtain drinking water from an improved source, while (10.1%) urban centers and (39.2%) rural centers use non-improved sources. The majority of people in urban centers use improved sources. The most common source of drinking water in town centers is piped water into the residents, dwelling place/plot/flat while in rural areas, the main water source is surface water followed by piped water into the homes, plot, flat, or yard. Almost 4% of all households in urban centers in Kenya have water piped in their premises while the majority of people in the rural areas have to walk for almost 30 minutes to fetch or buy water from various water vending points. Slightly more than half of the households in Kenya do not treat their drinking water which might expose them to waterborne diseases like Cholera. The commonly used water treatment methods are boiling and adding chlorine and other water treatment agents. Generally, 45% of households use suitable water treatment methods. If water is not available on the premises either through piping or drilling boreholes, households either collect rainwater or fetch from springs, rivers, dams or buy from water vendors. In rural areas, the collection of water is delegated to the women and young girls.

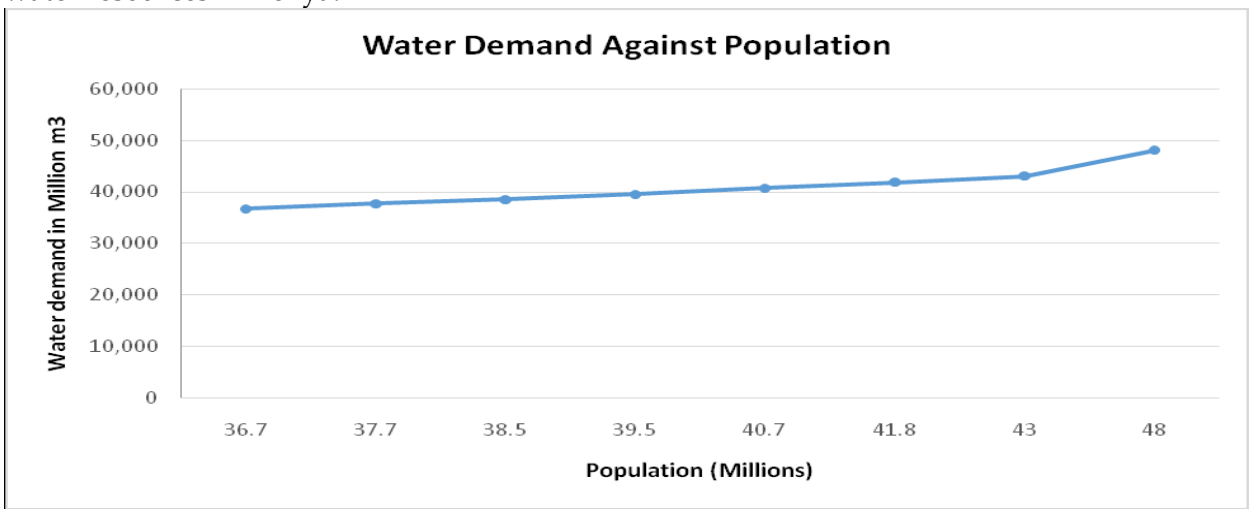
Table 2: Sources of Household Drinking Water

Sources of Water	Urban (%)	Rural (%)
Improved Source	88.2	59.1
Piped water into the homestead	45.5	15.0
Public tap	24.8	9.3
Public well /borehole	3.8	8.2
Protected well/borehole	3.9	10.3
Protected spring	3.4	11.6

Rainwater	2.6	4.5
Bottled water	4.3	0.2
Non-improved source	**10.1**	**39.2**
Unprotected well	1.7	8.8
Unprotected spring	1.2	5.5
Tanker truck	3.1	0.8
Surface water	4.1	24.0
Others	1.7	1.7

Source: *Kenya's National Water Master Plan (2015)*

Figure 2 indicates a positive correlation between water demand and population growth. As the population increases, water demand keep on rising, the pressure on natural water sources keeps on increasing. With a positive correlation, a high population poses a great threat to already scarce water resources in Kenya.



Source: *African Ministers' Council on Water (AMCOW) annual reports, Ministry of Water and Sanitation (2018).*

Figure 2: Population growth and total water demand for all sectors

3.2 Economic Analysis of Water in Kenya

Water conservation is a method of tapping as much water as possible and storing it in tanks or reservoirs. Kenya, like many African countries, might not achieve the Sustainable Development Goals and other national goals like Vision 2030 and development targets if the existing water scarcity condition prevails. Agriculture, forestry, fishing, tourism, and mining contribute to over 40% of Kenya's gross domestic product (GDP). These sectors depend on freshwater. WASREB's role in setting water tariffs is the most suitable way of ensuring water sustainability. WASREB uses tariff adjustments as a crucial economic instrument for enhancing efficiency in water use and safeguarding the financial sustainability of water service providers. The board ensures that the tariffs are just, suitable, easy, and encourage water conservation. Cost-conscious tariffs help providers to effectively carry out their operations without disappointing their customers. It helps them to meet the operation and maintenance costs ensuring a constant flow of water (WASREB, 2015).

3.2.1 Financial Water Costs

In Kenya, the cost of connecting water through the pipes is very high at $400 which is unaffordable to most households. This is worsened by the fact that the water companies do not give the potential customers the option of paying gradually unlike other essential providers like Kenya Power. The connection must be paid in full before the water connection. Compared to developed countries, the cost of water is generally higher in Kenya and Sub-Saharan Africa. For instance, water from Nairobi Water costs between 19–54 Kshs/m3. A household without access to piped water from the public water companies either buys water from tankers, boreholes, or bottled water from water supermarkets and shops. Tankers sell water at 450 Kshs/m3, 5-50Kshs per 20 liters jerry cans, and 50Kshs per liter of bottled water (African Development Fund, 2015).

Figure 3: Shows residents getting water into their jerry cans from water kiosks in a rural area.

Piped water in comparison with buying water from tankers and other water vendors is much cheaper. Households who buy water away from their houses/ yard/plot pay water periodically not volumetrically. Periodically meaning paying for every liter purchased while volumetrically means paying for cubic meters whereby a bill is given after a given period. Households whose main water source is piped water spend approximately Ksh. 410($4.8) while those who source water from water vendors spend almost four times this amount that is approximately 1600Kshs monthly (World Bank, 2015).

Figure 4: Shows a water vendor (Nairobi) supplying commercial establishments with water on his cart using jerry cans previously filled at water deport/storage tank/borehole.

Due to frequent water rationing especially in big cities like Nairobi, Kisumu, and Mombasa, households are forced to buy water from water vendors that increase their monthly budget for water. The frequent rationing results in water scarcity in households and the only option is sourcing water from tankers or other water vendors depending on their buying ability. Water vendors do not have constant charges, unlike state-owned water companies. Their charges vary depending on where they operate from and the economic status of their clients. Some households buy more than 10 jerry cans daily during rationing but water vending does not exist during the rainy season this could be due to the fact that the water volume in water sources is usually high in the rainy season and low in the dry season

3.2.2 Capital Costs

To cope with water scarcity, households either invest in water storage containers or dig boreholes. Others invest in bicycles, carts, and motorbikes to assist in fetching water from other sources like rivers or privately owned boreholes. This helps to reduce costs incurred when water is delivered by a tanker or water vendors who use carts to deliver water to homes in 20L (liters) or 30L jerry cans. The majority of households with piped water connections in Kenya have invested in water storage tanks with a capacity of between 100L, 200L, 1000L, and 1500L. The costs of the storage tank range between 300-60,000Kshs. The average cost of a build-up rainwater collection system with a capacity of more than 2.5m3 is approximately Kshs.9000. Digging a private well/ borehole costs approximately Kshs. 35,000 or Kshs 1000 per foot of depth. An average private well ranges between 20-35 feet (Amos, Rahman & Gathenya, 2016).

3.2.3 Water Treatment Costs

To ensure water is safe for drinking, it has to be treated to prevent water-borne diseases like Cholera, Typhoid, and diarrhea. Water is treated either through boiling, filtering, and the use of chlorine, water guard, or solar disinfection. Some treatment methods like filtration and

distillation have very minimal financial costs while others like the use of water guard, boiling, and chlorination are associated with some costs. The use of water guards and boiling methods are for small-scale water treatment whereas chlorination is used in large-scale water treatment. Water boiling is associated with costs like fuel (firewood, gas, paraffin) or electricity.
Homes with piped water connections or privately owned boreholes incur fewer water costs as compared to those who travel for more than one kilometer to get water. Homes with higher income incur higher water coping costs than low-income earners. Big households have many needs for water since they live in Bungalows/Mansions while low-income earners live in small houses. They might only need basic needs like cooking and bathing while high-income earners use excess water especially in washrooms and general cleaning (Wanjama, 2010).

3.2.4 Water harvesting

Water harvesting is the collection of rainwater. Water harvesting is a cheap and simple method for dealing with water scarcity. Rainwater harvesting is essential in areas where there are problems of environmental degradation, long dry seasons, and a high population increase. Arid and semi-arid areas usually experience drought where there are irregular rainfall and water is lost to the ground. In areas that are prone to drought, water harvesting is usually practiced through water pans and gutters. Water harvesting helps to conserve both water and soil. Several methods have been used for many years to harvest water for domestic use, agriculture, livestock, and industrial use. In Kenya, there is an increasing focus on water harvesting through the development projects by county government, Non-Governmental Organizations, state ministries, and other agencies as a decentralized solution to Kenya's water scarcity (Black et al. 2017).
A study by Mwaura, Koske, and Kiprotich (2017) revealed that benefits accrued from water harvesting are more than costs incurred in building or buying water collectors. The benefits include improving the value of livestock in the rural areas, saving time wasted while traveling to fetch water, or engaging water vendors, which could otherwise be used, in other income-generating activities. Besides, water harvesting saves water used in irrigation reducing the costs of agricultural activities to the farmers. The study also indicated that water harvesting successfully manages costs resulting from extreme weather conditions like drought. A long period of drought and floods are common in arid and semi-arid areas in Kenya. The most notable droughts were in 2001, 2003, 2006, 2009, and 2011 and major floods in 2006, 2010, and 2016.

3.3 Water Management

Through the Water Act 2002, the National Policy on Water Resources Management and Development gives the guidelines on how to manage water resources and provide water services countrywide. This act outlines the institutional and legal framework for managing and developing water resources and providing water services in Kenya (The Republic of Kenya, 2002). The management of water and water sources has been under the control of the government of Kenya until the private entities stepped into this water sector to provide water to the gated communities in the urban centers recently. Some households have boreholes to supply them water while others get the water from other private suppliers. According to the National Water

Development report in 2006 by the government, the unsustainable land and water use policy has caused mismanagement of the water sources. In addition, ineffective laws and regulations placed by respective institutions, increasing water pollution, ineffective water allocation practices, and the degradation of water sources, water catmint areas, aquifers, and wetlands lead to water misuse and shortage in the country (Mutui, Omosa & Cun-Kuan, 2016).

Through the Water Act 2002, re-evaluation of the role of different actors in the sector and re-assignment of roles was carried out. Before the Water Act in 2002 was enacted, all water service provision was centralized and controlled by the National Water Conservation and Pipeline Corporation with the help of few entities, which were created in the year 1992. After the enactment, decentralization occurred allowing 91 local Water Service Providers (WSPs) to join the water sector. In Kenya, reforms have been carried out since 2002 to improve the management of water resources and increase access to water and sanitation services for both rural and urban populations.

There has been a wide set of implications on the water sector since the constitution was passed in 2010. The constitution acknowledges the need to access clean and safe water as a basic human right. It thus assigns the responsibility of supplying water and sanitation services to the 47 counties established in the country in their attempt to fulfill the importance of devolution in proper service provision to citizens. A new water act was enacted in 2016 that ensures that the water sector was more decentralized to include the water service provision in the 47 counties. The 47 waterworks development that was created were made to be part of the operationalization of the 2016 water act. The Ministry of Water and Irrigation under the National government remained with the mandate to create and develop the water policies. The 2016 water act was enacted to align the Water sector objectives with the constitution's devolution objective. It states that the functions in the water sector are both a responsibility of the county and national government hence they need to cooperate in ensuring citizens get water services. There is also a priority given to water use in domestic settings over that on irrigation and other uses.

The Water Act is in place to ensure the effective use and management of water resources. The Water Towers Conservation and Coordination Policy complements the Water Act by ensuring that there is adequate reception of water in the water towers for management under the Water Act.

Several institutions have been set up in pursuit of the act in accordance with the decentralizing of the water sector like the establishment of the Water Services Regulatory Board (WASREB). The main mandate of (WASREB) is to develop and enforce rules within the water sector to ensure access to efficient, sustainable, and affordable water services to Kenyan citizens. Water Sector Trust Fund (WSTF) also created under the act was restructured from Water Services Trust Fund. Its mandate is to finance water and sanitization service provision in the country. The institutions were established as an effort to organize the water sector and fulfill the anticipated universal access to water in the country (Water Resources Management Authority, 2016).

A report by UNICEF (2015) shows a direct link between water management, human life, human health, the health of other plants and animals. Effective water management has a significant effect on the health of the population. This is due to contamination of drinking and bathing water,

wastewater, solid waste, air pollution, etc. Because of this effect on health, Human capital is adversely affected.

3.3.1 SWOT Analysis of Water Resources Management in Kenya

Strengths • Kenya is home to great water towers in East Africa such as abundant rivers like Tana and forests like the Mau Forest (Ministry of Water, Irrigation and Sanitation, 2006). • Water Resources Management in Kenya possesses strong support from donors like the World Food Program and the World Bank (Belay, Semakula, Wambura & Jan 2010). • As a country that falls within the tropics, water resources are made available due to fair weather throughout the year accompanied by rains. • Possession of strong strategies and policy papers like National Water Resources Management Strategy and Water Policy Sessional Paper Number 1 of 1999. • Possession of transboundary water resources that are yet to the explored fully. For example, Kenya shares Lake Victoria with neighbors, Uganda, and Tanzania.	**Weaknesses** • Low levels of investment in pollution control • Low levels of investment in reducing the discharge of effluence from factories. • The high cost of connection of the urban residents to the metered water resource. • Lack of development of a real and sound financial system for water management and supply. • Poor water piping and sewerage location planning in the informal sector in Kenya(World Bank, 2015). • Inadequate provision of assessment resources, for instance, low assessment of the volume and speed of the rivers, data to monitor groundwater is also lowly collected, and fully operational river gauging stations have reduced.
Threats • Water catchment areas like Ewaso Ng'iro are degrading at a faster rate due to the addition of sediments. • Variable, Spatial, and Temporal Rainfall Patterns make it hard for water to reach some parts of the country (Ministry of Water, Irrigation and Sanitation, 2013).	**Opportunities** • Implementation of the Water Reform Strategies to tackle the challenges. • Opportunity to increase collaboration with local and international partners to better manage water resources (Belay, Semakula, Wambura & Jan 2010). • Building broad-based stakeholder involvement and creation of

• Increase in the salinization of the water resources • Infiltration of cartels and bureaucracy in water resource management • Lack of modern storage equipment, a threat to the harvesting and storage of water during flooding.	transparency in the use of funds as a way of attracting more donor support. • Opportunity to take advantage of the increase in population and irrigation demand to make more water resources available to residents and conserve water catchment. • Opportunity to continue raising awareness of water catchment among communities and encourage tree planting.

3.3.2 Water Resources In Kenya In Comparison With Other Eastern Africa Countries

In comparison with neighboring countries, it's clear Kenya has the lowest water resource per capita. As indicated below, South Sudan has the highest water resources per capita while Tanzania has the highest water precipitation in volume. Kenya and Somalia have water resources per capita lower than 1000m^3 making them water-scarce countries. On the other hand, Uganda, Tanzania, Rwanda, Ethiopia, Burundi, and Eritrea have water resources per capita between 1000-2000 qualifying them as countries facing water stress conditions. Water dependency indicates the percentage of water that comes into the country from other countries (Transboundary waters). Kenya has 33% water dependency from other countries, Eritrea has the highest (62%) water from other countries while Ethiopia recorded 0% of the water from other countries.

Table 3: Water Availability and Use Statistics

Countries	**Renewable Water Resources (billion m^3/year)**	**Water Resources per Capita (m^3/person/year)**	**Water Precipitation In Volume (billion m^3/year)**	**Water Dependency (Water from outside the country)**
Kenya	31	617.7	365.6	33%
Uganda	60	1,402	285.0	35%
Tanzania	96.3	1,680	1,015.0	13%
Rwanda	13	1,089	31.9	29%
Ethiopia	122	1,162	936.4	0%
South Sudan	50	3,936	579.9	66%
Burundi	13	1,154	35.5	20%
Somali	15	997	179.8	59%
Eritrea	7	1,443	45.2	62%

Source: *Water use statistics*. (n.d.). Worldometer - real-time world statistics. https://www.worldometers.info/water/ (2017)

3.4 Challenges Facing Water Management in Kenya

The water management sector has faced challenges for many years in Kenya. Among the challenges is the perception that the government should provide water to all its citizens free. This led to an unwillingness to pay water bills which contributes to increasing water hawkers in Kenya. This becomes unviable for water institutions in Kenya because of the lack of enough revenue from water provision in the country. Water scarcity is more prevalent in rural areas and to a very great extent in Arid and Semi-Arid Areas. The conflict that arises in water sources also challenges water management in Kenya. For instance, there are frequent conflicts between competing upstream (irrigation and hydropower) and downstream (irrigation and livestock watering) the Tana River Basin.

According to (Chepyegon, C., & Kamiya, D. 2018), it is evident that about 42% of the water in the country is accounted for by Non-Revenue Water (NRW). The rural areas, arid and semi-arid areas are the areas in Kenya that are quite facing water shortages which is a challenge to the female gender who are given the role of fetching water for domestic use. Climate change has contributed to water shortages in many parts of the country and the situation is not getting any better. The supply of piped water in the rural areas is a great challenge and this affects irrigation and agri-business.

The budget allocation for the water sector in Kenya is indicated below the amount needed to satisfy the increasing water demand. 2.8% of the national budget is allocated to the sector is which is approximately 44% of the required cost of investment (UNICEF-KENYA, 2019). The availability of funds determines the extent to which capital investments can be made and conducting needs baseline surveys. Additionally, managers, ability to source funds through customers' water bills makes planning decisions very hard. Failure to involve the community before making any development like piping through people's compounds leads to top-down policies which in most cases do not help in solving people's real problems.

Poverty problems are usually linked to water challenges. Introducing rainwater harvesting improves water availability, its closeness, its quantity, and its quality. However, due to poverty, many people in rural areas and urban settlements cannot afford to buy water storage facilities like tanks and they only use available household resources to harvest rainwater.

The management of the rural water supplies has been left under the Community Based Organizations mandate due to unfavorable conditions to enhance commercialization of the water management sector. The CBO members do not have adequate management skills to manage these facilities effectively hence leading to water misallocation and misuse.

4. CONCLUSION

Kenya is a water-scarce country and the high population increase has worsened the situation. Population increases cause high demand for water exerting more pressure on natural water sources like rivers, swamps, natural dams, and lakes which are diminishing at a very high rate. Only a small percentage of the whole population has access to drink water. This is due to high water costs, inadequate and unreliable rainfall, poor water management, and a lack of water conservation skills. The most common source of drinking water in town centers is piped water

into the residents, dwelling place/plot/flat while surface water is the main source of water for rural residents followed by piped water into the homes.

In Kenya, the cost of connecting water through the pipes is very high at $400 which is beyond the reach of many households especially in the rural areas and urban settlements. A household without access to piped water from the public water companies either buys water from tankers, boreholes, or bottled water from water supermarkets and shops. Homes with piped water connections or privately owned boreholes incur fewer water costs as compared to those who travel for more than one kilometer to get water. Homes with higher income incur higher water coping costs than low-income earners which makes it even hard for low-class people to access clean water. In the Arid and Semi-Arid Areas, water harvesting is usually practiced through water pans and gutters. Benefits accrued from water harvesting are more than expenses of building or buying water collectors.

Under the Water Act National Policy on Water Resource Management and Development established the Water Services Regulatory Board to oversee the management of water resources provision of water services in Kenya. However, water management faces challenges, which include the perception that the government should provide water to all its citizens for free which has created unwillingness to pay water bills leading to cutoffs for piped water. The budget allocated to the water sector in Kenya is inadequate to satisfy the ever-increasing water demand since the availability of funds determines the extent to which capital investments can be made and conducting needs baseline surveys. The water situation in Kenya, therefore, calls for suitable management of the water sector in Kenya to ensure that majority of Kenyan citizens if not all can access clean water for drinking, domestic, and livestock use.

5. RECOMMENDATIONS

Climate change and its unpredictability continues to have a negative effect on the availability of water sources. There are uncertainties created by the current projections on climate change regarding the availability of water sources. According to Sustainable Development Goal 6, all stakeholders have to implement integrated water resources management practices appropriately at all levels, including transboundary cooperation. Competent managers should be hired to oversee the management, protection, and preservation of the water resources for future generations.

The water demand is very high in Kenya while its distribution to the users is diminishing. There is a need to increase the availability of water by supporting the construction of sustainable water sources like boreholes and protecting springs and rivers. The community should be encouraged to make more investments in rainwater harvesting to increase access to safe water and also reduce water costs since borehole, springs, and river water is not billed. The government should also reinforce laws and regulations aimed at the protection of water resources and water catchment areas.

To curb some challenges that impede access to safe household water supply, safe water sources close to homesteads at least 200 meters should be located and exploited. This might help to

decrease health issues like cholera and typhoid and also increase water consumption as well as alleviate poverty levels. People should be empowered to start income-generating activities in

rural areas to help them raise money to pay water bills for safe water. Water coverage in rural areas should also be increased through investments in water storage facilities that can be used by many people.

There has been a mere 4% increase in water coverage within the past five years. To achieve the target in vision 2030, the water sector needs to grow at least by 4% per year that is thrice the current rate. In many towns in Kenya, water demand is higher than its production leading to water rationing.

The key challenge is ensuring that all water projects are successful to achieve the intended goals. However, many water projects in the communities especially the boreholes in areas where there are no pipe connections are not successful. This is mainly because stakeholders who are only focused on construction costs drive the project. They, therefore, end up overseeing the construction of substandard projects that cannot sustain the entire community. Therefore, investments in infrastructure should be increased to ensure more water projects are established in areas that frequently face water challenges.

The financial sector's sustainability is facing a threat from water losses. Funds that could increase access to and improve water and sanitization services are wasted. According to the 42% Non-Revenue Water levels and the Ksh.20.67 billion billing, the total loss in 2016 and 2017 is estimated as Ksh.7.8 billion while the acceptable losses are at 20%. The customer should thus control the use of non-Revenue Water since it contradicts the country's aspiration to enhance standards of living by being the direct expense.

Many utilities continue to operate on the non-cost reflective tariffs even though they are underperforming. This has continued to be a setback in the desire for full-cost recovery since the tariffs do not cover the cost. Currently, to cover the inefficiency of the system and the inability of the tariffs to cover the cost, an additional Ksh.27 should be either subsidized to the water supplier or added to the customer's bill. It has forced the utility managers to explain the situation to the authorities in the country to help them understand the need to enhance cost recovery tariffs and the deterioration of services resulting from the persisting investment gap existing in the water sector. The players in the water sector are also encouraged to explore models that are efficient to provide services to their customers like the utilization of the economies of scale to enhance efficiency in water sector service delivery.

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