

# Access to Water in Kenya's Coast Region: A Challenge to Community Development and Poverty Alleviation in Lamu County

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## Abstract

Water is considered a basic commodity and essential for life - living on planet earth is dependent on it. However, access to water has been and will continue to be a dilemma for a majority of the residents at the coast of Kenya. A close look at the window on "Coastal Resources and People" reveals that water is a key resource but despite its immense importance, many people especially in the rural areas and among the Vulnerable and Marginalized Groups (VMG's) do not have adequate access to potable, reliable and convenient sources of water. Lamu, currently considered among water scarce counties in Kenya as per the Lamu County Integrated Development Plan ([http://lamu.go.ke/wp-content/uploads/2016/03/LAMU\\_CIDP-Revised\\_June\\_2014-1.pdf](http://lamu.go.ke/wp-content/uploads/2016/03/LAMU_CIDP-Revised_June_2014-1.pdf)), faces serious challenge of provision of potable water to its residents. With the influx of people from other parts of the country as a result of the implementation of the Kenya Vision 2030 flagship project - Lamu Port Southern Sudan Ethiopia Transport (LAPSSET) Corridor, the current water stresses is only expected to worsen. The Lamu County Government plans to address the ever-increasing demand for access to water but resources to actualise these plans are yet to be consolidated. To complement this situation, Kenya Coastal Development Project (KCDP), a World Bank funded project is working with local communities in Lamu in the development and implementation of community-led water projects targeting to increasing access to water at the household level.

This paper will focus on community-based approaches to understand the water-web in Lamu East Sub-County to provide an assessment of opportunities, challenges and sustainability implications. Primary data is used on surveys, Social Assessment (SA), Vulnerable and Marginalised Group Plan (VMGP), observations and recommendations from the Lamu CIDP. It further proposes that direct usage of saline water, seawater or brackish water, for sanitation purposes could alleviate the freshwater shortage.

**Key words:** Water-web, challenge, sustainable development, community driven demand.

## INTRODUCTION

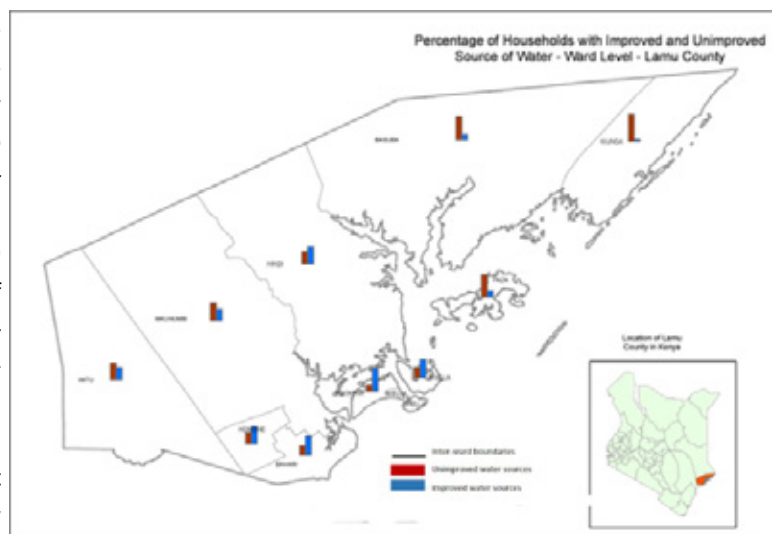
The 6<sup>th</sup> and 7<sup>th</sup> Goals of the Sustainable Development Goals (SDGs) and Millennium Development Goals (MDGs) respectively focused in part on water scarcity, with a target of halving the number of people around the world without sustainable access to safe drinking water and basic sanitation services. Today, 91% of the world's population uses an improved drinking water source, compared to 76% in 1990, but water scarcity still affects more than 40% of people, across every continent (UNDP, 2006).

Water is crucial in several other sectors apart from the portable water and sanitation. As highlighted by the United Nation Millennium Project (2004). The United Nation's General Assembly through Resolution 64/292 explicitly recognises the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential for the realization of all human rights. This is fortified by the Kenyan Constitution promulgated in 2010 and further strengthened by Kenya Vision 2030 and the Ministry of Environment Water and Natural Resources Strategic Plan 2013 – 2017. Under Article 28, of the Kenya Constitution 2010, every person has inherent right to have the dignity respected and upheld. The human right to good quality water is indispensable for leading a life in human dignity. The Kenya Constitution 2010, states that "every person has inherent dignity and right to have the dignity respected and upheld". The human right to good quality water is indispensable for leading a life in human dignity.

Kenya has been classified as a water scarce country by World Health Organisation (WHO, 2003). Only 48% of the country's ru-

ral population has access to an improved drinking water source according to Kenya National Bureau of Statistics (KNBS) and Society for International Development. Fig. Shows the percent availability of water in household of Lamu County.

Improved sources of water comprise protected spring, protected well, borehole, piped into dwelling, piped and rain water collection while unimproved sources include pond, dam, lake, stream/river, unprotected spring, unprotected well, djabia, water vendor and others



**Fig. 1: Lamu County summary of households with improved and unimproved source of water at the Ward level based on Kenya National Bureau of Statistics. Improved sources of water comprise protected spring, protected well, borehole, piped into dwelling, piped and rain water collection while unimproved sources include pond, dam, lake, stream/river, unprotected spring, unprotected well, djabia, water vendor and others.**

The time spent in pursuit of water collection often prevents people, particularly women, from concentrating on income generating activities, or in the case of school going children, leads to poor school attendance and performance. Fig. 2 shows a typical scene at a water collection point. Due to the water scarcity in the rural areas, waterborne diseases are not uncommon.

Lamu County has land surface area of 6,300 km<sup>2</sup> composed of 5,500 km<sup>2</sup> of arable land 800 km<sup>2</sup> of non-arable land, 130 km<sup>2</sup> of coastline and 308 km<sup>2</sup> under water mass. Lamu West sits on land surface area of 3,970 km<sup>2</sup> hence taking 63.3% of total land, leaving Lamu East with 36.7%. Kiunga division in Lamu East occupies 96.6% of Lamu East land surface area. The bulk of arable land is in Lamu West while Lamu East takes the bulk of water mass.

The County covers a strip of north-eastern coastal mainland and the Lamu archipelago, which consists of around 65 islands, which extend about one hundred kilometers south from the Somalia border. The most well-known of the islands is Lamu Island, and is termed as “the oldest and best-preserved Swahili settlement in East Africa” in the CIDP 2013 – 2017 but neighbouring islands also have numerous archaeological remnants of history dating as far back as the 14<sup>th</sup> Century (<https://www.pinterest.com/pin/558657528756715021/>).

It has been suggested that most of this settlements may have collapsed in parts of the archipelago and its hinterland due to lack of access to fresh water. However Lamu Island has continued to thrive as a result of its reliable sand dune recharged aquifers. Rain Water Harvesting (RWH) has however been embraced in the other islands with the construction of the underground RWH storage tanks, locally known as *djabia*. The current water is greatly supplemented by saline or brackish water boreholes.

In Lamu County, 53% of residents use improved sources of water, while the rest relying on unimproved sources. There is no significant gender differential in the use of improved sources of water, with 53% of male headed households and 54% in female headed households using improved water sources respectively. Lamu West constituency has the highest share of residents using improved sources of water at 61%. That is three times Lamu East constituency, which has the lowest share using improved sources of water. Lamu West con-

stituency is 8 percentage points above the county average (Fig. 1).

On the other hand total of 57% of residents in Lamu County use improved sanitation, while the rest use unimproved sanitation. Improved sanitation is higher in female headed households at 61% as compared with male headed households at 55% (KNBS and SID, 2013). Lamu East constituency has the highest share of residents using improved sanitation at 72%. That is 19 percentage points above Lamu West constituency, which has the lowest share using improved sanitation. Lamu East constituency is 15 percentage points above the county average. Faza Ward has the highest share of residents using improved sanitation at 78%. This is almost 51 percentage points above Witu Ward, which has the lowest share using improved sanitation. Faza Ward is 21 percentage points above the county average.

Although the link between water and poverty may be easy to grasp, the issue of how to safeguard our water so that the communities can gain access to the resource necessary for consumption and production is still complex and needs close attention.

This paper seeks to address the following:

- Water and poverty nexus in Lamu County.
- Compare the cost effectiveness of KCDP approved projects, based on Rain Water Harvesting (RWH) techniques in Lamu County as prioritized via Community Driven Development (CDD) approach.
- Present the case of water needs for the Vulnerable and Marginalized Groups (VMG).
- Highlight alternative ways of addressing water management to meet the current water demand based on the cultural practices by the indigenous communities of supplementation utilization of saline or brackish water.

## METHODS

Based on the current KNBS statistics and Lamu County water department, 28 villages were studied to identify the water and poverty nexus in Lamu archipelago and its hinterland. 16 villages in Faza, Kiunga and Basuba Wards were considered. These villages depended on RWH using the underground water tanks, locally known as *djabia* as their major source of freshwater. The number



*Fig. 2: Women and girls queuing for water from an opened underground water tank, djabia in October 2013 – the month when water is usually scarce. The queues are long that may lead to conflicts and they take more than WHO standard of not more than 30 minutes to draw water from one point even though they are not located Dfar from the households.*

of current available djabia's, and their storage capacity and the total village populations were identified to determine the prevailing freshwater deficit based on the WHO standard of 50 litres of water per individual per day.

On the other hand, the 12 villages inhabited by the Aweer (Boni) tribe considered to be the poorest were engaged. They are among the Vulnerable and Marginalized Group (VMG) as defined in article 260 of the Kenya Constitution and includes groups covered by the World Bank's OP 4.10. article 56 which mandates the State to undertake affirmative action programmes to fast track the integration of minority and marginalized communities into the mainstream social and economic life of Kenya; article 204 (l) which establishes the Equalization Fund for fast tracking development of basic services such as the provision of water to bring them to par with other areas of Kenya; article 174 (e) which mandates the county government to protect and promote the rights of minorities and marginalized communities.

The Social Assessment (SA) in which a sample of VMG villages participated actively in formulating action plans was followed by validation workshop in which representatives of VMGs from the sample villages had the opportunity to discuss the SA findings, make amendments and give their approval for the findings and prepare a Vulnerable and Marginalised Groups Plan (VMGP). Each village being represented by a total of 8 persons, undertook the identification, prioritization and budgeting for their preferred and culturally appropriate social economic-livelihoods and micro-enterprise project to achieve sustainable development.

Built on VMGs representative prioritization and ranking of their major projects namely water, public sanitation, education, health, infrastructure support, agriculture, micro-enterprise, tourism and fisheries sub-sectors. The village's need of water, the community proposed source of water and distance to water points were provided as summarised in the VMGP.

On the other frontier, based on the three Rain Water Harvesting (RWH) projects approved through KCDP grants award on the Community Service (CS) window to the Community Based Organisations (CBOs). The cost effectiveness of the traditional underground tank, convectional roof top catchment and novice use of plastic tanks was evaluated. This is through the Community Driven Development (CDD) projects awarded to three community based organisations in Lamu East Sub-county villages of Siyu, Ndau Island and Tchundwa to two CBOs namely: Girl Child Protection, youth and disabled community groups respectively.

## RESULTS

The results show the achievement of the MDGs, and further explore challenges to sustainable implementation of RWH and proposes and some interventions which the government and other stakeholders could implement to overcome them. Fig. 3 shows graphic presentation of water deficit situation in various villages of Lamu in along the scale of the MDG target for 2015.

All of the 16 villages water demand is a priority apart from Faza/Rasini which is the most developed village and is the proposed beneficiary of Iranian funded water project that plans to supply borehole water through from the mainland in Vumbe to Faza Island though undersea water piping system. Kizitingini which is the most densely populated (25% of the threshold) and Kuinga's Shanga Village and Basuba are the hardest hit as water does not achieving the 7<sup>th</sup>

MDG. None of the villages has met the MDGs threshold of more than 50% access to portable water.

The water need as prioritized by the Aweer (Boni) tribe show that apart from Mansghuda and Malkamansa villages the rest of the village's prioritized water as zenith to their sustainable development in comparison to other social-economic projects. The ranking was inversely proportional to the distance to water



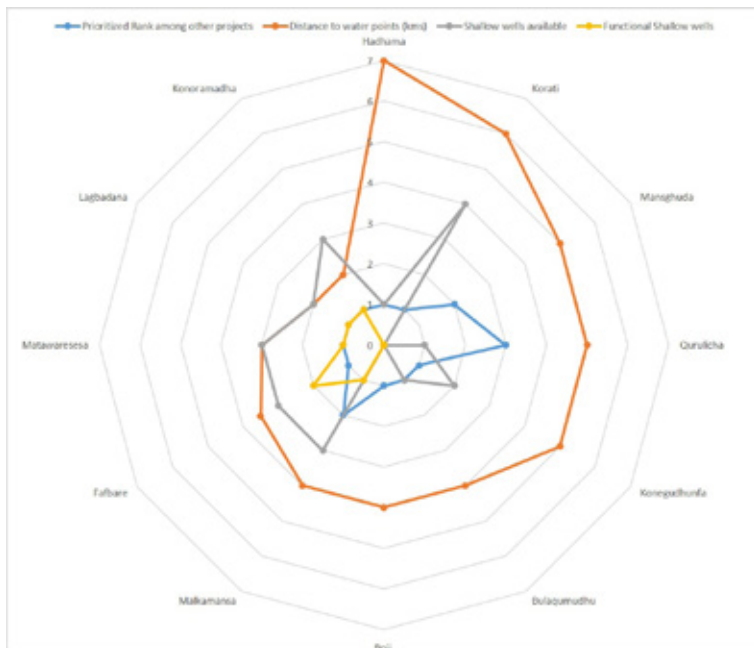
**Fig. 3: Water-web on the percentage deficit of water supply based on the Millennium Development Goals (MDGs) target of supply of water to 50% of the population by 2015 is far from being achieved in the case of Lamu Archipelago and its hinterland. They highlight water demand for some of the major villages based on the current standards by World Health Organisation (WHO) that recommend minimum of fifty litres of water per individual per day and the water source has to be within 1 kilometres of the home and collection time should not exceed 30 minutes.**

point, while it was directly proportional to the availability of shallow wells that are functioning. Fig. 4 Shows the water deficit situation of the villages occupied by the Boni VMG.

It is worth noting that most of the shallow wells dry during drought periods and through 9 out of 12 villages were advised to sink boreholes, the high salinity content of such ventures are a major risk. The 3 of the villages opted for traditional RWH using djabias. This has however avoided during the appraisal of more than 20 CDD projects as had been proposed by CBOs in Lamu archipelago. These decisions can be validated by lessons learned by KCDP was based on several factors that stand out during the approved water project in Lamu County.

Three CBOs namely Siyu Girl Child Protection Youth Group, Muungano wa Walemavu and Al-Fattah Self Help Group had their RWH projects approved,. Their community driven development projects to improve access to domestic water for Siyu Village to benefit the girl child, roof water harvesting project for the physically challenged persons and a convectional djabia rehabilitation in Ndau Island by a youth self-help group. The rain water structures are highlighted in Fig. 5 showing in each case the situation at the project site during inception and after completion ().

From the active projects the following projects were identified and their capacity to hold water, catchment surface area, cost, drawing point, benefiting community members among others factors that enable the determination of the best practice determined. The greater the values that directly account to



**Fig. 4: Water-web based on the current Vulnerable and Marginalised Group Plan (VMGP) after Social Assessment for the Aweer (Boni) tribe in Basuba Ward. Ranking of villages based on their water needs, other factors such as prioritized rank among other projects, distance to water points, shallow wells available and functional shallow wells are considered.**

the improved RWH, the better the method (Fig. 6).

The RHW method can be categorised into three, namely the Traditional djabia, Convectional/Improved djabia and Modern protected plastic water tank.

Lastly, informed about the Lamu archipelago culture and studies over the current epoch, a group of researchers from Hong Kong, The Netherlands and South-Africa developed, tested and applied a novel approach to water management in coastal cities, where saline water is used as secondary quality water. This is based on the fact that desalination is still a very expensive process that needs a lot of energy, plus the brine waste of high salinity from the process is still hard to dispose. Neophyte approach addressing traditional issues such as the need for a dual water system, requirement for use of non-corrosive materials, issues with  $H_2S$  formation, impact of increased salinity on biological

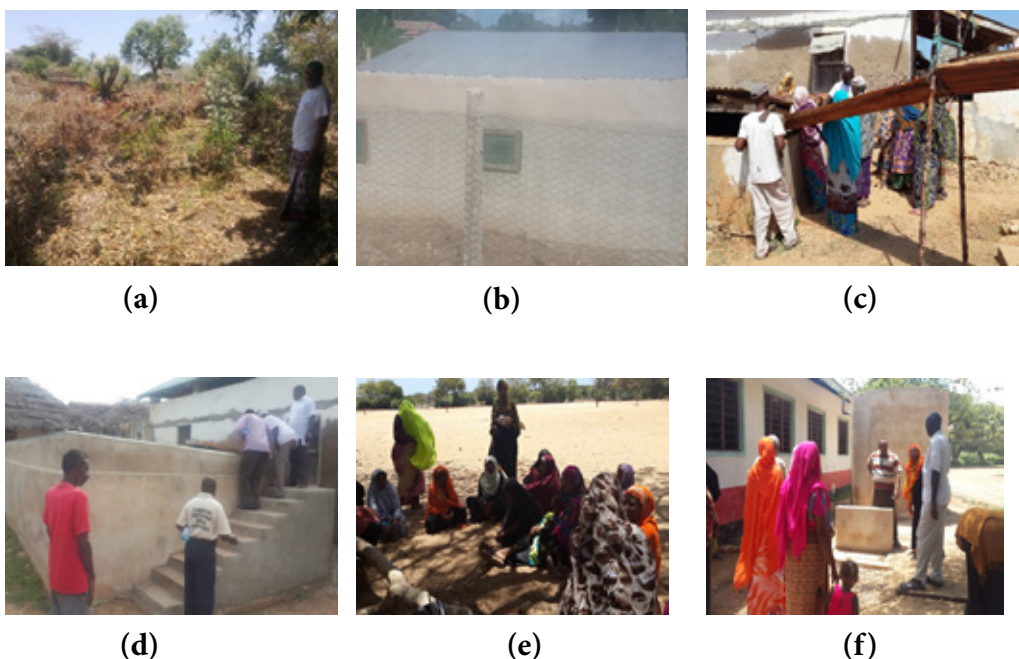
wastewater treatment, reduced reuse options due to saline effluent, and lack of proper cost-benefit analysis of different options, in a holistic fashion and introduces novel technological interventions and developments at various parts of the urban water infrastructure system. Direct use of saline water replaces a substantial part of freshwater usage, exploits sewerage as a bioreactor and introduces new Sulphate reduction, Autotrophic denitrification and Nitrification Integrated (SANI) process technology for treatment of sulphate-rich wastewaters. This concept has evolved over the last 50 years in Hong Kong and has recently matured to the degree that can be applied at full scale for sustainable development in proposed the LAPSET resort cities.

## DISCUSSION

The delicate link between access to water and poverty reduction was weakened when the decade of water declaration became operational into MDGs. Where halving the world's poor population become Goal No. 1 while the issue of securing access to safe drinking water only became a target under Goal No. 7, on 'Ensuring Environmental Sustainability'. However, the goal of halving the number of people without access to clean water is turning to be one of the most cited and well known of the MDGs. It has turned out to be one of the most difficult to achieve as in the case of Lamu County.

The county population as projected in Lamu stands at 124,092 persons (<https://www.knbs.or.ke/download/statistical-abstract-2015/>), with 64,827 male and 59,265 female and more than 70% live in Lamu West. The envisaged opportunities from the LAPSET project is expected to attract huge influx of immigrant population estimated to be over 1.0 Million. This will certainly overstretch the county's social services necessitating commensurate development planning for adequate service provision. This will bring about dimensional shift in the county's sustainable development needs.

Water is an important factor in settled communities, and the evolution of public water supply systems will be tied directly to the growth of Lamu County. The



**Fig. 5: Plates on transformative status of the water of the 3 funded Rain Water Harvesting (RWH) projects funded by Kenya Coastal Development Project (KCDP) in Lamu Archipelago. Plates (A - B), (C - D) and (E - F) highlight the former and current state of project site for Girl Child Protection Youth Group, Al-Fatihah Self-Help Group and Muungano wa Walemavu Self Help Group respectively.**

county is among the regions that suffer from historical marginalization. The low development achieved is also concentrated in Lamu West Sub-County while Lamu East Sub-County continues to suffer massive under development to date as came out in the Lamu CIDP.

To call water the basis of life doesn't give it enough credit, yet we often treat water as an afterthought, until it's gone in to the ground for us to begin exploiting it. Already, 1.2 billion people, or nearly a sixth of the world's population, live in areas afflicted by water scarcity, and that Fig. could grow to 1.8 billion by 2025 (<http://www.un.org/waterforlifedecade/scarcity.shtml>). Globally, the rate of water withdrawal water diverted from an existing surface or underground source increased at more than twice the rate of population growth over the past century. Climate change could intensify desertification in already dry parts of the planet.

The world is projected to hold 9 billion people or more by 2050 and they'll all be thirsty. So in now and beyond, the challenge of water scarcity will only grow, which could lead to global instability. But it doesn't have to be that way. Efficiency can stretch existing supplies by ensuring that overall water use fall even as the population grows. The truth is that we can do anything with water – except go on without it. Water produced by the plant is tasted for quality before it is sent out for consumption at a premier cost. But for the less privileged RWH still remains the principle source of freshwater freely available from nature.

Water and sanitation facilities and services must be available and affordable for everyone, even the poorest. The costs for water and sanitation services should not exceed 5 per cent of a household's income, meaning services must not affect peoples' capacity to acquire other essential goods and services, including food, housing, health services and education.

Water is inseparable with sustainable human economic and social development. One of the eight MDGs and eighteen targets, target 10, is on water supply services. Water underpins virtually all the MDGs. Water has many quite fundamental and quite different facets and functions in human societies. Therefore, the assessment of the role of quality water as the concept of water as a human right are not trivial. The importance of water and sanitation as drivers for health, quality life, food security and as a pillar for economic development is unique. Besides being fundamental to many economic sectors, water is also a key to meeting many of the basic needs that are in turn instrumental in poverty reduction.

Prior to 2002, the government of Kenya had focused on nationalizing water supply through a centralized body and large-scale water projects, including the promotion of the goal of universal water supply by the year 2000. However, there was a growing realization that the government lacked resources and capacity to attain such goals, and that alternative solutions would need to be found. With the introduction of Kenya's Water Act of 2002, the national government provided more freedom and autonomy to allow other government and non-government bodies to supply water by providing a more conducive environment to facilitate a decentralization of water supply. As a result, new water sector institutions have been created, and new ideas for water supply have come about. One of the ideas gaining attention with this new system has been RWH, which may previously have been treated as an afterthought or lacked applicable knowledge. With this growing awareness and interest, there is increasing possibility for RWH to be incorporated in water supply strategies. Halving the proportion of people without sustainable access to safe drinking water and basic sanitation, is one of the targets of the 7th MDGs (Onda et. al. 2012). RWH, which provides water directly to households enables a number

of small-scale productive activities, and has the potential to supply water even in rural and peri-urban areas that conventional technologies cannot supply. As part of the effort to achieve the MDGs, the government has committed itself to provide financial assistance to poor households for the capital cost of rainwater storage tanks and related works in the rural areas. Despite this financial assistance, the legal status of RWH remains unclear and RWH is in fact illegal by strict application of the water legislations. Beyond the cost of installation, maintenance and proper use of the RWH system to ensure its sustainability, there is risk of waterborne diseases.

Lamu is proposed to have "Collaboration City" located at Mokowe with the core facilities such as water sports, country club, fishermen's wharf, cultural center, convention center and amusement center (as part of the Kenya's Vision 2030). The Satellite facilities are eco-tour points include marine and land sports, fishing, market, surfing, nature safaris and archaeological sites. The eco-villages are proposed at Kipini, Bawaya, Manda Island, Pate Island, and Kiwayuu Island all this will have a lasting stress in the available freshwater resources or its availability will be unadorned minimum. The main sources of water include rainfall, surface water, groundwater, and desalination of sea water. Ground water sources are the major water sources for most of the water supplies in Lamu, with most areas in the County having saline groundwater. Surface water sources include the lakes, pans, dams, seasonal rivers and the sea.

Water in the county is managed by various institutions. Lamu Water and Sewerage Company (LAWASCO) controls the distribution right to Mokowe and Lamu water systems. Lake Kenyatta Water Association supplies water to Mpeketoni area, Witu and Hindi Water User Associations manage water supplies in Witu and Hindi areas and are community based schemes. Other public water sources such as dams and djabias are managed by community committees. Rain harvesting structures are used to collect water for domestic use. Desalination of sea water is mainly done by hotels and private individuals since the process is costly and the average distance of household to access clean water is 5 kilometres.

Of all services for sustainable development, provision of potable water is perhaps the most vital. People depend on water for drinking, cooking, washing, carrying away wastes, for livestock and other domestic needs. Water supply systems must also meet requirements for public, commercial, and industrial activities. In all cases, the water must fulfil both quality and quantity requirements. This is the greatest dilemma that sustainable development in Lamu County does face. Water supply system, infrastructure for the collection, transmission, treatment, storage, and distribution of water for homes, commercial establishments, industry, livestock and irrigation, as well as for such public needs as fire fighting and street flushing is a necessity.

Water is present in abundant quantities on and under the Earth's surface, but less than 1 percent of it is liquid fresh water. Most of Earth's water is in the oceans or frozen in polar ice caps and glaciers. Ocean water contains about 35 grams per litre of dissolved minerals or salts, making it unfit for drinking and for most industrial or agricultural uses. There is ample fresh water—water containing less than 3 grams of salts per litre,—to satisfy all human needs. It is not always available, though, at the times and places it is needed, and it is not uniformly distributed over the Earth. In many locations as is the case of Lamu the availability of good-quality water will be further reduced because of urban development, industrial growth, and environmental pollution.

Uncontrolled environmental degradation and effects of climate change negatively impact on the socio-economic sustainable development of the county.



**Fig. 6: Water-web comparing three methods namely i) Traditional underground rainwater storage tank. ii) Convectional roof catchment to a raised storage tank and iii) Roof with a protected plastic water tank, of Rain Water Harvesting (RWH) in Siyu, Ndau and Tchundwa villages respectively as funded by Kenya Coastal Development Project (KCDP).**

Human activity is the major contributor to environmental degradation in Lamu County. These activities include deforestation through illegal logging, charcoal burning, forest clearing for agricultural activities, overstocking and subsequent overgrazing, illegal quarrying and water pollution through waste disposal. The depletion of mangrove forest reduces reproduction of marine life, deforestation and overgrazing leads to desertification and reduce rainfall and water sources, water pollution leads to water borne diseases while climate change has increased the frequency of high tide flooding.

KCDP supports projects geared towards maximizing the social benefits and promoting services and actions that enhance social-wellbeing in the six coastal counties. The pivotal recipients are vulnerable groups, women, youth and self-help groups pulling together with a common interest to provide solutions to their teething problems but are in need of financial boost to address their recurrent problems. During the first round of the project more than twenty water projects from Lamu were put on hold awaiting scientific sound practices. This action is clearly justified from by the current complete RWH projects. This has resulted to the county receiving the lowest of approved projects requested by the CBOs. This would have otherwise gone a long way in addressing a clear demand of fresh water, because the region is located in the Arid and Semi-Arid Lands (ASAL).

The Aweer are a remnant hunter-gatherer group living along the Kenyan coast in the North-Eastern parts of Lamu County on the mainland. The community lives in a total of 12 villages in the forested areas within Witu and Boni forests with a population of about 8,000 persons (KNBS, 2009, Kenya Population and Household Census, Page 397). The gazettement of all the forest by the government has become a source of conflict. To ensure social, economic and cultural benefit to the VMGs poverty must be lifted and access to water is aimed at bringing them at par with other communities in the Coast and Kenya at large. The applied interventions must be culturally appropriate and aim at preserving and promoting cultural practices and income generating. This can be achieved by ensuring the free, prior and informed consultations to enable

their involvement and participation at every step of VMGP implementation.

The VMGP provide a clear road map on the needs and aspirations of the Aweer (Boni) tribe. They present measures and actions to be taken in order to strengthen and enhance the social, livelihoods and economic visions so as to uplift their quality of life. It further provide measure for mitigating and perceived adverse effects that may result from the implementation of KCDP. It also provide a clear mechanisms for sustainably engaging the local communities to participate and benefit from project's interventions and investments. Provision of water if implemented as provided in the VMGP will be capable of fast tracking the integration and inclusion into the mainstream social-economic sustainable development of Lamu as envisaged by article 56 of the Constitution of Kenya, 2010.

Safe domestic water is a basic necessity for good health. In addition it is particularly significant for women and children, usually girls in rural areas, who bear the primary responsibility for carrying water, often from long distances. The Aweer rely on borehole /open well and spring/river/ponds which frequently dry up during dry seasons.

However, scarcity of water among the tribe is a barrier to irrigated agriculture which has high potential in the areas occupied in KCDP project area.

As a result of combined effects of population growth, rapid urbanization, densification of urban area and climate change, people are increasingly experiencing freshwater shortages in Lamu and the situation is expected to be only worsened in the near future. Traditional mitigation measures, like introduction of water saving devices or RWH, are often insufficient in solving the problem. Therefore, novel alternative urban water management strategies need to be further explored and developed as an answer to ever increasing water stress. These strategies should preferably be focused on the reduction of the demand for freshwater and introduction of new approaches to urban water management that often includes a paradigm shift.

The main concerns affecting abstraction of groundwater from the Lamu archipelago and its hinterlands current freshwater aquifers include, sea water intrusion, depletion of fresh groundwater resources, over abstraction on water resources by developers and the local communities, reduction of natural vegetation, forest cover and agricultural land due to un-planned developments. This leaves harnessing of rainwater harvesting and use of saline and brackish water as key frontier in addressing the fresh water demand.

#### Recommendations

The poor continue to have insufficient water as long as the belief persists that there are no alternatives or that the cost are too high. The responsibility to invest in water rests not only with the Ministry of the central government but also with County governments and other stakeholders, but ultimately it is also a responsibility of every household as good quality and fresh water for the poor pays both economically, socially, health wise and environmentally.

Direct saline water, seawater or brackish water, usage for toilet flushing could alleviate the freshwater shortage, but its worldwide application was hindered due to several issues and challenges. The introduction of saline water to the urban water system is relatively simple, safe, sustainable and economically

affordable in urban coastal areas. The novel approach if successful in Lamu archipelago will address major concerns and challenges that hindered its wider use in the past and opens window of opportunities for its worldwide application as about 50% of the major cities are have easy access to this ubiquitous marine resource leaving Lamu County as a trailblazer.

Finally, as proposed in the Lamu County Integrated Development Plan (CIDP), the use of ubiquitous amount of saline or brackish water is the way out of the current water quagmire. This has been the culture of all Lamu archipelago natives who have uniquely been able to continue to live without the basic human right of water, affecting their health, safety and survival even though they are among the world's most marginalized and impoverished families. The paper calls for urgency in providing of scientifically backed technology to increasing the magnitude of use of saline water in bathing and sanitation options. This is not only been proven to be cost effective and therapeutic, but also economically viable as in the case of Hong Kong which has practiced it for over 5 decades.

## ACKNOWLEDGEMENTS

This work was supported by the Kenya Coastal Development Project (KCDP) through its component of community grant scheme Hazina ya Maendeleo ya Pwani (HMP). KCDP was funded by the World Bank and Global Environment Fund (GEF) and hosted at the Kenya Marine and Fisheries Research Institute (KMFRI). This work would not have been possible without collaboration from the Lamu County Water Office in sharing information concerning the prevailing water conditions and the Lamu community members that were part of the study.

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