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# Water resources and sustainable development in northern Kenya: a case of Isiolo district

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## ABSTRACT

Water is literally the source of life on earth. The human body is 70 percent water. The study examined water resources and sustainable development in Northern Kenya in Isiolo District. Residents of Isiolo formed the target population. Cluster sampling was used to select villages which are more affected by scarcity of water. The study used survey design. The analysis was both qualitative and quantitative. The study found that inadequate water resource supply has been hindrance to the Tourism Development in the region particularly in Isiolo District and the Southern parts of Garissa District. Secondly, inadequate water resource supply in the region has limited employment opportunities in the area this explains the low income per capita of people in this region. In addition, their standard of living, income generation, labor efficiency, employment extra is rather low, because agricultural productivity industrial development is both in adequate due to water constraint in the area. Water scarcity has been a source of conflict in the study area. The overstocking as well as water scarcity in the area and also the nomadic pastoralist nature of the people of this region has resulted in constant migration of people with their animals from one district to another. However, despite the aridity nature of this area, some limited agricultural activities is possible mainly through irrigation. The paper recommends that the use of water harvesting technologies that are sustainable and environmental friendly should be given priority in both surface and ground water development; incentives to adopt roof catchments water supply should be encouraged and cost - sharing policy in water sector to meet both development and recurrent votes should be encouraged to reduce the budgetary constraints by the government.

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## Introduction

Water is literally the source of life on earth. The human body is 70 percent water. Human beings can survive for only a few days without fresh water. In many places, people are drawing water from rivers, lakes, and underground sources faster than they can be recharged - "unsustainable resources" as one researcher puts it. Currently, 31 countries- mostly in Africa and the Near East - face waters stress or water scarcity.

Population growth will push an estimated 17 more countries, with a projected population of 2.1 billion, into this water - short age categories within the next 30 years. By the year 2025, 48 countries, with more than 2.8 billions of global populations in 2025- will be affected by water scarcity. Another nine countries, including China and Pakistan, will be approaching water scarcity.

Beyond the impact population growth itself, the demands for fresh water has been rising in response to industrial development, increased reliance on irrigated agriculture, massive urbanization, and rising living standards. In this century, while world population has tripled, water withdrawals have increased by over six times. In developing Countries over the past decade water withdrawals have been increasing by 4 percents to 8 percent a year. The supply of fresh water available to humanity is shrinking, because many freshwater resources have become increasingly polluted. The lack of fresh water is likely to be one of the major factors limiting economic development in the decades to come warns the World Bank.

Globally, between 12.5 and 14 billion cubic metres of water (12,500 to 14,000 cubic Kilometres) are considered available for human use on an annual basis. This amounts to about 9,000 cubic metres per person per year, as estimated in 1989. By the year, 2025 as global per capital availability of fresh water is projected to drop to 5,100 cubic meter's per person as another 2 billion people join the world's population. Even then, this amount would be enough to meet human needs if it were distributed equally among the world's population.

Global per capital figures on water availability gives a false picture. The world's available freshwater supply is not distributed evenly around the globe throughout the seasons, or from year to year. In some cases water is not where we want it nor in sufficient quantities. In other cases we have too much water, in the wrong place, at wrong time.

## Background of Northern Kenya

The area of covered in this paper, includes the Northern Districts of Isiolo, Garissa, Wajir and Mandera – which covers an area of 152,507 Sq., Km, with a total population of approximately 535,546 people as per population estimates of 1996 as state on table below.

District	Area	Population (2000)
Isiolo	25, 605 sq.km	97,575
Wajir	56,501 sqkm.	157,983
Garissa	43,931 sqkm	156,733
Mandera	26,470 sq km	138,691
Total	152,507 Sq Km	535,546 People

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Sources: District Development Plans 1994 - 1996:  
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This region of the country may be classified as arid and semi-arid areas. As Gilbert white (1960) has said: "There are no clear boundaries of arid lands; there are as many lines on maps as aridity in climate plants land forms and soils In addition, climatically defined boundaries shift from years to year. Adopting this scholar's definition, then desertification may be defined as: "a process of sustained land (soil and vegetation) degradation in arid, semi-arid, and dry sub humid areas caused at least partly by man. It reduces productive potential to an extent which can either be readily reversed by removing the cause or easily reclaimed without sustained investment"

Dry land Degradation occurs in various degrees. It is the result of complex interacting factors of physical, social, economic and political origin, among the most important are excessive land- use pressure, seasonal dryness and drought stress, periods of increasing aridity and the natural vulnerability of dry lands. Past attempts to define these (dryland) areas have been based on a variety of parameter's such as precipitation, evaporations, temperature, relationships, soils and plant communities ( Healthcote, 1983). One method of characterizing dry lands is as areas where average rainfall is less than the potential moisture losses through evaporation and transpiration. As such dry lands can be viewed as areas where growing season is limited by a lack of moisture. Given temperature conditions suitable for plant growth, a growing season is a period when water is available to plants from moisture stored in the soil. Soil provides storage for water from which plants can extract it through their roots. Judging from the Northern region climatic conditions as pertaining to the concerned districts, temperature, evaporation, transpiration, availability of rainfall, growing season 4 and extra, the region fits in the description of arid and semi-arid areas or dry land. For instance, Wajir district lies within sahelian climatic region which is characterized by long dry spells and short rainy seasons. Annual precipitation averages 200 mm and the evapo--transpiration averages 250 mm. In all these districts, the average mean rainfall is always below 400 (mm) during any heavy rainy years.

The region is low lying within altitude ranging below 500 meters above sea level. The plain rises gently from the south and east towards the north rising to 460 meters in Bute and Gurar at the foothills of Ethiopian Highlands. The region is far away from the coastal influence, with mainly seasonal river running across - Isiolo and Mandera. The northern region of Kenya under consideration is undeveloped in comparison to other regions of Kenya such as Central Province or Western province. The socio- economic indicators pertaining to illiteracy rates, per capital income, availability of education facilities, extra, give evidence that the region is still far from being developed. A quick glance at the educational facilities in the Region shows that there are just about (25) secondary Schools, approximately (150) Primary school, one Teachers Training College and a few Youth Polytechnics in the Region to serve over a half a million population in the area. This explains why high rate of illiteracy in the region. The agricultural activities are less developed, due to aridity nature and inadequate rainfall. This is only possible irrigation. As such, there is inadequate food (like cereals & vegetables) supply in the region. Livestock production is the major economic activities in this religion, but this important economic activity is also being constrained by inadequate water resources supply.

Industrialization process in this region is undeveloped, because of in the region and water scarcity which makes

agriculture activities- either naturally or through irrigation rather impossible, underdevelopment of socio-economic infrastructures (for instance; roads, water distribution and delivery facilities), appropriate technology and inadequate capital facilities in the area. Thus, the income per capital of the region's residents is rather low, due to low income generating activities and mass unemployment in the area. All in all, the general underdevelopment in the Northern Region of Kenya may be explained purely on water resources constraints in the region, which limits the economic activities in the area.

### **Water Resources Supply and Development in Northern Region of Kenya**

Water is crucial development issue in the region. It is one of the main constraining factors to the development of other sectors like agriculture, health, industries and livestock production. The availability of water source is another important factor determining the settlement pattern of the region. Population tends to concentrates in the, water points or along the seasonal rivers that exist in the area. Therefore water resources distribution and delivery in the area is of significance important. Thus, the D.N habitat conference held in Vancouver - Canada in 1976 echoed the need of all governments especially, those in developing world to provide clean water for all by the year 1990.

In subsequent special D.N water conference in Argentina (1981), the need for clean water was articulated. Freshwater is emerging as one of the most critical natural resource issue facing humanity. As the year 2000A.D approaches, the world population is expanding' rapidly. Yet there is no more fresh water on earth than there was 2,000 years ago, when the populations was less than 3 per cent of its current size. Water is literally the source of life on earth, the determining factor to development in general, and to Northern Region of Kenya in particular.

In Kenya, the government emphasized the need to provide her citizen with clean water within a reasonable distance throughout the Country by 2000 AD but, this could only be possible in high potential regions because of the availability of natural water reservoirs- (i.e. permanent rivers, lakes etc) while the ASAL areas - northern Kenya areas inclusive, had not yet been able to develop appropriate water resources supply infrastructures to fulfill this policy. Mass poverty in this area of the country could be attributed to water resources scarcity, which restricts rapid economic developments especially in the agricultural sector in this region.

There are also striking differences in water availability within countries. For instance, in Kenya, most parts of central province, Western province, parts of Nyanza Province and Rift Valley which are high potential tends to have good access of water supply as compared to Northern Region of the country. In Kenya, there re two major source of water resources;

i) Surface water

ii)Ground water

The surface water supply system depends on the availability of natural reservoirs such like lakes, rivers, streams and runoff as result of availability of rainfall in the area. The Northern Region surface water supply system is unreliable because it lacks lakes, permanent rivers and streams and erratic rainfall in the area. For instance, in this regions, Isiolo district has only four perennial rivers (Isiolo Ewaso Nyiro, Garamara and Kinna), Wajir district - seasonal swampy or Laghas, Bhogal area and in the western and Southern strip of Habaswein Division, Mandare district -Daua river, and Garissa district- Tana Rivers on the southern "boundaries which forms the single source of permanent water for the sprawling and fast growing Garissa

Town or However, in Garissa district, seasonal river or Laghas are found all over the district and greatly interfere with road transportation during wet seasons.

Subsequently, considering the availability of seasonal rivers, streams, dams and permanent rivers and area covered in this region, we may draw conclusion that surface water supply is poorly distributed in Northern Region of Kenya. In addition, seasonal distribution IS another factor to consider. For instance, the supply tends to be more during the rain seasons when floods causes destruction on roads, irrigation schemes etc. Ground water is another important water supply source in this region, given the aridity nature and inadequate development of the surface water infrastructure in the area. This is where water is being mined from the ground. This to a large extent depends on nature of the existing rocks which will determine the aquifer, the available technology of extracting water from the ground and the availability of substantial capital to be invested in this sector. Under this arrangement, water is actually being supplied to the human beings or irrigation through the drilling of boreholes and perhaps shallow wells.

However, ground water supply is rather expensive, since it requires one to invest heavily on the infrastructures to harness it, such as drilling machines to sink boreholes. At the same time, water quality is disappointing, since it is salty in nature in many places such as Wajir Town, Modogase and Garbatulla and being unfit for human, livestock and even agricultural consumption. But it remains the main sources of water supply in this region.

Throughout much of the developing world (Kenya inclusive) the fresh water supply comes in the form of seasonal rains. Such rains runoff too quickly for efficient use. India for instance, gets 90 percent of its rainfall during the summer monsoon seasons, which last from June to September. For the other eight months the country gets barely a drop of rain. As result of the seasonal nature of the water supply, India and some other developing countries can make use of no more than 20 per cent of their potentially available freshwater resources.

This is also true in apply to the Northern region of Kenya whereby during the rainy season, much of it forms the run off causing floods, hence, inefficiently being used for economic activities, yet the rest of the month the region suffers inadequate supply of water resources which prohibit development in the areas. Therefore, to improve in the water distribution and delivery in the region, appropriate technology in dam construction is necessary to ensure spread of dams across the area to harness the runoff water for economic use.

Many countries attempt to move water from where it occurs in nature to where people want it, and also to store water for future use. The Egyptians built thousands of canal and irrigation ditches to capture the Niles water in order to grow crops, worldwide, there are some 40,000 dams, built in the last 50 years, globally. Therefore, to develop the Northern Region of Kenya the government and other stakeholders in development must look into the water distribution and delivery network in this area - by adapting appropriate technology for dam constructions to harness the runoff water during the rainy season. This also shall make water available for irrigation activities - hence making good use of the available irrigation scheme and creating new one the region.

In the words of Professor Todaro:

"Development should therefore be perceived as a multi - dimensional process involving the re-organization and reorientation of entire economic and social systems. In addition to improvements in incomes and output, it typically involves radical changed in institutional, social and administration structures, as well as in popular

attitudes and sometimes even customs and beliefs"

Water resource supply; therefore, tend to have direct bearing in the socio-economic development in the area. This becomes crucial in the Northern Region of Kenya, due to its aridity in nature which means that any economic activities depends on the availability of water supply, the wheel of development in the northern region therefore, can be moved by equitable water supply and delivery in all sectors in the region. According to Peter Gleick, president of the Pacific Institute for Studies in Development, Environment and security, average of 20 to 40 liters of fresh water per person per day IS generally considers to be a necessary minimum to meet needs for drinking and sanitation alone. If water for bathing and cooking is included as well this figure varies between 27 and 200 liters.

According to the world health organization, 30 million people die from epidemics and contagious diseases carried by polluted water each year. In many poor countries, Kenya included, water borne diseases account for 80 percent of all diseases, after malaria, water borne and hygiene - related disease are the second largest killer of children in Kenya. The situation is rather crucial in the Northern Region of Kenya where there is serious shortage of domestic water supply. The water scarcity in the region have greatly reduced the standard of living of the people in the area, cause increase in the child mortality rates, caused health hazard - hence, reduce Labour efficiency, reduce the life span of the people and causing general underdevelopment in the region This explains the high rates of child mortality and low standard of living in the region.

Agricultural development in the northern region of Kenya is insignificance due to unreliable rainfall and inadequate water supply. Crop farming is only possible in the region but the irrigation water is always scarce to meet the demand of many interested farmers in the region. Therefore, the region is net importer of the cereal product from other regions. Livestock production is the most important economic activity in the region. Majority of the populations in this area earns their livelihood directly or indirectly from livestock production. However, even the livestock sub-sector's productivity is also being limited by inadequate water supply. For instance, in Garissa District, the available water points adequately serve about 30% of the human population and 20% of the livestock with the rest surviving under very difficult conditions of aridity. This explains the boreholes syndrome problem in this region. Therefore, development in the agricultural sectors requires improvement in the water resources supply, to initiate the irrigation projects and livestock productivity in the region. Most of the irrigation schemes in areas like Malkadaka, Kinna- Rapsu, Bute - Gurar, Garfasa, Merti have been under - utilized dye to water -scarcity. Therefore, dam construction spreading all over this region to store the runoff water may help in increasing irrigation water supply. This combined with canals to deliver water to the actual farms and proper management of irrigation water and canals shall improve production in the agricultural sector and development in general.

For proper distribution and delivery of water resources supply in northern areas of the country for the purpose of achieving rapid development in the region, the government must invest heavily on the water supply infrastructures such like water dams, drilling of bore holes/shallow wells, irrigation schemes. Proper water management, especially in the existing irrigation schemes is another means of ensuring well distribution and delivery of water in the region

The area is also least developed in terms of industrial development. Even in the few urban towns that exist such as Garissa, Isiolo, Wajir and Mandera Town, apart from the

provision of the government services, and commercial services, no significant industries do exist. However, the region is potential for the development of cement industries due to the availability of Limestone, which is an input in the cement industry. Other industries likely to be developed in this region are – meat processing and skin processing industries. But both these prospective industries in the area have been limited by inadequate water supply.

Inadequate water resource supply has been hindrance to the Tourism Development in the region particularly in Isiolo District and the Southern parts of Garissa District. Wildlife animal requires water for their survival, but if the drought is persistent, then the animal migrates to other areas especially high potential regions. Hotels accommodate, tourist also need water for domestic purposes. Sustainable Tourism Industry is required in the region to provide employment as well as to increase income generating capacity of their population directly or indirect involved in this sector.

Therefore, inadequate water resource supply in the region has limited employment opportunities in the area this explains the low income per capita of people in this region. In addition, their standard of living, income generation, labor efficiency, employment extra are rather low, because agricultural productivity industrial development are both in adequate due to water constraint in the area. The poverty incidence is rather high in the region. The capacity - building in the water sector in the next millennium shall have to concentrate in the dam construction to harness the surface water, control flood and provide the livestock with adequate water. More boreholes are to be drilled. This calls for heavy public and private investment in the water sector if it is to be achieved, then proper management of resources, accountability in the public and private sector and eradication of corruption in the political and economic sphere is necessary. People participation in the development affairs is also vital.

#### **Distribution and Delivery Problems and Challenges of Water Resource Supply in Northern Region of Kenya**

As a matter of fact, the success of development activities in this region depends on the availability of water resource supply- this is development challenge to economic planners in this region. The increase in the income per capita, standard of living and labor efficiency of the people in the region will depends on whether the planners are able to make water available to people living in the area. But above all, the distribution and delivery of water resources in area is crucial.

The distribution net work in the region is uneven, therefore, many water points are the center of settlement, while those staying some distance away from the source of water are to trek long distance in search of water. This causes man -hour loss in terms of labour efficiency, therefore, the starting point as far as development of this region is concerned is to ensure evenly water resource distribution network - spreading across the region.

The natural distribution pattern of natural lakes, rivers and permanent streams is limited by topography consideration and aridity nature of area. However, the adaptation of appropriate technology with regards to dams' construction, flood control and irrigation system would help in collecting the runoff waters during rainy seasons and store them strategically for future use. These dams, shallows wells must be allocated strategically throughout the region. In addition, to the foresaid dams and wells, the government, Non- Governmental Organization, the beneficiary people of the region and any other concern party must invest heavily in drilling and sinking bore holes since this is the only sure way of even by distribution of water resources in

Northern Kenya region.

In the 1970's Kenya Government did realize the significant role of water component in development as such the separate ministry of water was created to direct water policies of supplying it to the development needs of the people. In responses to this risk, the ministry water in late 70's came up with a policy to provide "Wananchi" (Citizens) with clean domestic water at distance less than two (2) kilometers by the year 2000 AD. This water resources delivery objective policy remains a dream in the northern Kenya region, whereby, the majority of the citizen trek long distance- approximately over ten (10) kilometers in search of domestics water.

Another distribution and delivery water resources problem in the region is the fact that, the water resources from the given surface and Ground water facilities is far less the demand (domestic, livestock and irrigation) of the people. In the first place, the northern people are mainly the nomadic pastoralist and therefore, the number of animal's are extremely above the available water resources. As such, this has resulted in overgrazing and over utilization of water bore holes in the area - degrading the vegetation around bore holes, seasonal swampy or langhas hence "borehole syndrome" of environmental degradation of the environment as a result of overstocking.

The overstocking as well as water scarcity in the area and also the nomadic pastoralism nature of the people of this region has resulted in constant migration or movements of people, especially the herdsmen in search of pasture and water. As a result of these movements of people with their animals from one district to another or one area to another has resulted in constant conflicts within the district boundaries, as well as clan clashes across, the district.

Nomadic Pastoralist in particular is a cause of clan conflicts in the water points and intra- district migration causing clan clashes especially over grazing lands and water points. For example, comparing the Wajir District census of 1989, - the district population .stood 123, 769, but during the 1991/92 drought year, the district had to feed 252,000 people, due to drought which was 120,213 people more than the district population due to influx of Nomadic Pastoralists from other districts especially Isiolo, Marsabit, Mandera and Garissa. This expalins the Wangalla incidence of 1983 and many other clan clashes particularly in Wajir putting the three major clans- Degodia, Qganden and Ajura us and sometimes with other clans a cross the district boundaries such has Boranas of Isiolo the Radiles and Boranas of Moyale and Marsabit and other Somali clans from both Garisa and Mandera. The clan conflicts and clashes are also common among the Garissa Isiolo boarder particularly around Garbatula, Kinna - Rapsu and sometimes in the Ewaso Nyiro plains around Merti, Garfasa, MalkadaCand Sericho areas. These are the main water points which forms the grazing areas, subsequently, other clans from outside the district have in many occasion tried to use them for grazing purposes, the unnumber paper to be inserted here.

There is another form of conflicts and clashes over water resources in the region, which we may term the economic conflict or agricultural conflict. This is purely in terms of economic consideration pertaining to irrigation schemes in the region and along the few perennial rivers where limited farming is taking place. For instance, along the River Tana in Garissa there is Kinna-Rapsu irrigation scheme. Malkadaka Irrigation scheme, Gf arfassa irrigation scheme and Merit irrigation scheme both in Isiolo, Bute - Gurar irrigation scheme in Wajir and along river Daua in Mandera district, decision is to be made on which crop is to be planted and therefore to make use of source of irrigation water. For instance, in the mid 1980's the

Kinna bulk - banana project was in stiff conflict with other crops, especially maize and vegetable which was both in high demand due to the fact that the Kinna Rapsu irrigation scheme was near to Garbatulla Township Maua Town and IvTeru - National park which meant ready market for both crops.

#### Resource Development Policies

The natural resources base of any country or region is of vital importance in the process of development. The key resources given to us by nature are land, forests, water, minerals and energy. Of these, it is water that sustains all human, animals and plant life on the planet water is essential for the existence of life. Rightly the president of the U.S.A Johnson in his address to the water conference (1967) observed.

*"As man faces the next century, one question stands above all others, how will and how can the earth sustain its ever growing population"*.

Therefore, as Kenya preparing to enter the next millennium, the Government needs to review her development objectives spelt out in the sessional paper No. 10 1965 entitled, African socialism and its application to planning in Kenya which declared war against the three development evils - poverty, disease, and ignorance. To attain the foresaid development objectives, the provision of supply of water and proper management of it is a challenge to the economic planners. This becomes more important in the northern region of Kenya, where any meaningful development or poverty eradication in the region lies on how well the water is available and distributed throughout the area.

By the introduction of the decentralized development policy of the District focus for Rural Development strategy in July 1983, the previously neglected ASAL areas of northern region had been given equal opportunity to develop their water supply infrastructures. In fact, the district focus for rural development strategy, aims at fulfilling the previous Governmental policy of making clean water available for domestic, livestock, irrigation and industrial development at reduced distance of 2Kms by 2000 AD.

This strategy looks forward's in achieving this by involving the beneficiaries or people in the projects identification, implementation and evaluation, efficient use of the budgetary of resources allocated to the water projects: However, in the late 1990's it had become clear that the above noble development objectives had been misused or abused, hence, the water projects had fail to yield to the intended purposes as a result of massive corruption, lack of. In fact, there are most recent incidences of clan conflicts in Northern Region of Kenya, particularly over watering points and grazing grounds. According to a survey carried over in the area, around the Dadabi area of Garissa - the Auhilians had been displaced by the government decision of establishing three (3) Refugee Camps in the area. These camps covers approximately 600KM<sup>2</sup>, mainly in the Hagandera-catchments area which in past had been the main grazing ground and source of water to the Auhilians clan. This displacement as a result of the Refugee Camps meant that, the Auhilians community had lost the grazing area that had been supporting their pastoral economy. Subsequently, the community migrated into two directions, while some move towards Garissa Town where they had been in conflict with another clan - the Abduhak, hence fifteen (15) lost their lives. Another group of the Auhilians move to Isiolo in Sericho Eldera areas and came into conflict with the Boranas of Isiolo, as such eighteen (18) people lost their lives. In all these cases, 25,000 pastoral families had been displaced and lost 800 herds of cattle. The recent conflict took place between May to July 1999, and a lot of tension is still being felt between the Boranas and Somalis

especially around the Eldera area and between the Auhilians and Abduhak of Garissa.

In Wajir, the Afurans and the Degodia have been in constant conflicts over the grazing grounds and watering points and between the Wajir clans and the Boranas and Radiles of Isiolo, Marsabit and Moyale District. Accountability among the implementing officers is very poor and the beneficiaries in the projects cycle have been neglected. With the implementation of the structural adjustment policy currently, the government has adopted the following water policies:

- a) The introduction of cost - sharing - sharing policy in the water sector-whereas, every one shall pay for the water used or consumed,
- b) That charge for urban water consumer will be such that they cover capital, operational and maintenance costs, while for rural supply the charges shall cover only direct operation and maintenance costs,
- c) Notwithstanding the above two policy positions, the ability to pay by water consumers will be taken into account so that the poor will not be denied water services.
- d) In addition to water charges, e.g. monthly meter, rent connection fee and deposit at the time of connection to the water supply and those also vary in different local authorities.

To achieve the foresaid water policies as prescribed by the Kenya government further policy guidelines are necessary:

1. The water sector privatization must be considered in light of water infrastructural development of particular area. While, cost - sharing in the water resources supplies necessary but, this may be rather effective in the urban areas and high potential areas of the country, but rather difficult in remote ASAL areas of Northern region. Therefore, in this region, the government must start by developing the water supply infrastructures- i.e. dams, boreholes, shallow wells and extra. Again, the clan relationship with regard to water facilities in the areas is also important. Because, from the social organization every water point or facilities in this region belongs to a clan.

Therefore, if privatization of water sector is to succeed, here, the government must look into means of water sharing and clan relationships including water points ownership in advance. However, the government may consider authorizing the local council authorities to own and manage the water points, dams Langhas in their areas and charge each water consumer accordingly. The beneficiaries may also consider the possibility of forming cooperative societies or public limited companies to manage, distribute and delivery water to the region to avoid the bureaucratic and corruption nature of the government.

2. The issue of the beneficiaries - People participation on water projects is Another issue to be tackled. In northern region, most people are ignorant of this requirement hence, believes that the government and government alone is responsive for development. Therefore, cost sharing policies, especially in the areas of water need to be emphasized to the people.

3. Despite the aridity nature of this area, some limited agricultural activities is possible mainly through irrigation. A number of irrigation schemes do exist in Isiolo, Bute Gurar area of Waiir. Along River Daa in Mandera and along River Tana in Garissa. But inadequate water supply and poor management has been a bottle neck to the success of these irrigation projects. Therefore appropriate water- sharing policies as pertained to these irrigation schemes is necessary.

4. Therefore, perhaps, the government may come up with clear policy to privatize these irrigation schemes, so they may be more efficient productive so as to enable the region to be self-sufficient in cereals, vegetable supply, and employment and income generation.

### Recommendation

1. The use of water harvesting technologies that are sustainable and environmental friendly should be given priority in both surface and ground water development
2. Incentives to adopt roof catchments water supply should be encouraged
3. Cost - sharing policy in water sector to meet both development and recurrent votes should be encouraged to reduce the budgetary constraints by the government.
4. To alleviate poverty in the Northern region of Kenya, water supply infrastructures need to be improved., through peoples' participation on water projects and proper management scarce capital for water development
5. The geological data of the region is necessary to enable the northern region planners, plan for evenly distributed water system in the area.

To avoid, the vegetation degradation of the water points, people should be educated to avoid overstocking and overgrazing

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