

An Analysis of the Challenges Affecting Improved Water Supply Coverage in Kenya

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Water is a precious natural resource, vital for life, development and the environment. It is recognised that water plays a key role in socio-economic development of any nation. The government of Kenya has a plan to transform the nation from a low-income to a middle-income country by 2030. As such ensuring universal access to water services is necessary in order to achieve this goal. However the Kenyan water sector continues to face various challenges which impede increased water coverage, causing the country to encounter economic water scarcity. This paper aims to analyse the factors affecting the sector, their interrelationship and proposes a strategy to overcome them. It emerged that causative factors are several, and as they evolve they conjoin into other problem scenarios characterised by: unsustainability and low social acceptance of interventions, low water availability, low investment in the sector and water-related conflicts. The proposed solution strategies to be adopted include: integrated planning, research & study, and monitoring in the sector; inculcating sustainability in interventions, involving stakeholders and adopting a funding strategy.

Key Words: Water, Development, Kenya

1. INTRODUCTION

The government of Kenya's current long-term development targets are contained in The Kenya Vision 2030 document that was rolled out in 2007 which aims at transforming the country into a middle income country by 2030 by targeting three main sectors: Economic, Social and Political. It acknowledges water as a vital component for the growth of economic and social sectors as the country gets industrialised and more urbanised. Therefore, the Kenya Vision 2030's aim is to ensure 'improved water and sanitation is available and accessible to all by 2030'. Additionally, the Kenya constitution promulgated in 2010 treats the enjoyment of clean and safe water in adequate quantities as a basic right for every citizen. Consequently, this increased water requirement puts a great demand in water resources conservation efforts (considering that Kenya is classified as a water scarce country) and development of the water services sector. This is not a new concept in the development path of Kenya in that earlier development plans recognised the pivotal role of water in development. Two years after gaining independ-

ence, Kenya, via the Sessional Paper No.10 of 1965, nationalised water and sewerage facilities amongst other utilities like transport and communication so that the government could take the responsibility of expanding these services as a basis for development.

By 1970, urban areas had achieved high water supply service coverage. However, the rural areas were lagging behind as services were less developed there. This led to the adoption of "bringing acceptable water supplies to all the rural population before 2000" slogan in the succeeding development plan of 1970-74. By 1979 this goal was not going to be met and the services in urban areas were getting strained by rural-urban migration. The government reformulated the strategy to read "to have an adequate water supply available to the entire population soon after the year 2000" in the 1979-83 plan

The successive failure to meet water sector targets prompted the beginning of reforms in the sector. Finally in 2002 new water laws were enacted in which the management of water resources and water services was separated, and the role of the central government was decentralised to semi-autonomous government agencies in order to improve efficacy in

service delivery. Since the roll out of new water laws in 2004, there has been a general consensus in the nation that there has been an improvement in delivery of water services, more so in urban areas. The sector however continues to face challenges. The targets in rural and urban water and sanitation coverage are not being met. The government aimed at achieving 80% access to safe and reliable water for urban areas and 75% for rural areas by 2015 but by 2013 it had only managed 72% and 44% respectively. It had also targeted at reducing non-revenue water to below 30% but 42% was reported in 2014¹⁾.

For Kenya to meet its development agenda, the water problem needs to be solved. Articulation of the sector's challenges is one of the starting points in the problem solving process. This paper aims to expose the current underlying factors in Kenya's water sector challenges, their interrelationship and propose a general strategy for improving the current situation. In order to gain an understanding of the challenges, the background information including regional variability of climate, source of livelihoods, urban & rural living patterns and current water sector management structure, are elaborated.

2. OVERVIEW OF KENYA

(1) Location, Administration and Population Characteristics

Kenya is situated in the Eastern part of Africa bordering the Indian Ocean. The country lies between latitudes 34° and 42° east and between longitudes 5.5°N and 4.7°S of Equator.

Kenya has a two-tier devolved type of government system: national and county governments. The country is divided into 47 counties. By and large the counties are occupied by distinct ethnic groups. There are over 40 ethnic groups in Kenya, each speaking different languages, and holding varying traditional cultures²⁾.

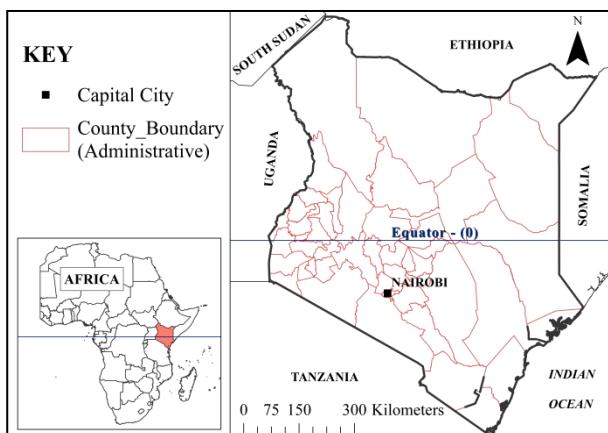


Fig.1 Location of Kenya

In 2009 Kenya's population was 38,610,097 with 67.7% of the people living in rural areas. **Table 1** shows summary population characteristics of Kenya.

Table 1 Population Characteristics of Kenya^{3), 4), 5), 6)}

Characteristic	Urban	Rural
Population	12,487,375 (32.3%)	26,122,722 (67.7%)
Average household size, (persons)	3.1	4.6
Literacy level, %	95.0	86.0
Poverty rate, %	33.7	49.1
Living area, (% of country's land area)	0.2	87.3
Average population density per sq. km	730	46
Slum dwellers	2,313,450	-

(2) The Rural and Urban Divide

Rural area is countryside, and it has contiguous settlement of sparse homesteads, except on forest, wetlands, hazard-prone areas and other protected areas. Urban areas on the other hand are more densely populated and built-up with shops, hotels, factories, universities, hospitals, offices, rental houses, etc., and are characterised by modern life with access to more amenities like running water, electricity, transportation, grocery stores, and others. Rural areas are less developed than urban and therefore the penetration of services and commerce is lower. Consequently, rural poverty levels are higher and literacy levels lower compared to urban.

Urban residents earn their living through wage income and commerce whereas in rural areas people are directly dependent on crop and animal agriculture (**Table 2**).



Plate 1: A densely populated rural area in agricultural zone

(3) Economic Significance of Agriculture

Agriculture contributes 25 – 30% of Kenya's Gross Domestic Product (GDP)⁷⁾. Nationally, it

provides over 70% of employment⁸⁾. 98% of Kenya's cropping is rain-fed; just 2 percent is irrigated⁹⁾. Irrigation provides 18% of the value of all agricultural produce and directly contributes 3% of total GDP¹⁰⁾. Maize is the dominant and most important food crop for the nation. Despite this, Kenya is still faced with persistent food insecurity problem. Food poverty was 45.8 percent in 2006⁶⁾.

Table 2 Proportion of Source of Livelihood for Households¹¹⁾

Source of Income	Percentage
Agriculture – those who depend on both crop and livestock. They are directly engaged in agriculture	57
Wage employees – those employed in the service sector. They are mostly in urban areas	24
Entrepreneurs – those who gain over 60% of their total income from self-employment activities, mainly commerce	19
TOTAL	100

(4) Topography and Climate

The topography of Kenya is diverse, rising gradually from sea level at the Indian Ocean in the east, to the highland plateaus in the west (Fig.2). There are mountains, plateaus, valleys, highlands, lowlands and coasts forming the Kenyan landscape.

There are two distinguishable rainy seasons in the country: long rains which occur from March to May (MAM) and short rains from October to December (OND)¹²⁾. The amount of rainfall varies with location. In general, the climate patterns are largely determined by elevation: the highland areas are cooler and receive most rainfall as opposed to the low-lying areas that are hot and dry, except for the coastal strip (Fig. 2 and Fig. 3).

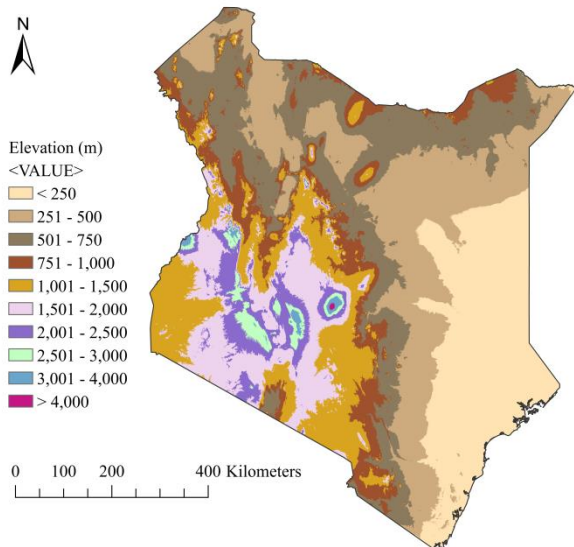


Fig.2 Elevation map

The dry areas are locally classified as Arid and Semi-Arid Lands (ASAL). They occupy 87% of Kenyan landmass and it is vast in the north and north-eastern parts of the country. In this region, rangelands dominate, consisting mainly of bushlands, and to a lesser extent, savannah grasslands and woodlands. The humid zone is composed mainly of montane forests and agricultural lands.

(5) Land Potential and Settlement Patterns

The highland areas (humid zone) have high land potential. It is a preferred settlement area because it has favourable conditions for agriculture which is the main source of livelihood for majority of households. On the other hand ASAL areas have low land potential, hence low population densities and larger administration units (counties) as shown on Fig. 4.

A mix of dairy cattle, food, and cash crops dominates the high-potential areas, where 90 percent of Kenyan croplands occur. The croplands are smallholder (less than 2ha) and they are owned and cultivated by homesteads. This zone has rich biodiversity and harbours Kenya's important water catchment areas.

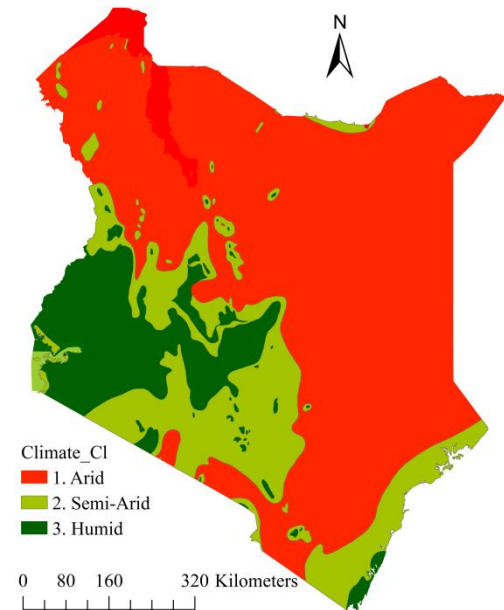


Fig.3 Climatic zone map

Table 3 Characteristics of Climatic Zones in Kenya¹³⁾

Climate Classification	Average Annual Rainfall, (mm)	Average daily day-time Temp Range (°C)	Average Annual potential evaporation (mm)	Ratio of Kenya's Land Area (%)
Arid	150 – 550	24 – 30	1,900 – 2,500	68
Semi-Arid	550 – 850	16 – 30	1,650 – 2,300	19
Humid	850 – 2,700	14 – 22	1,200 – 2,200	13

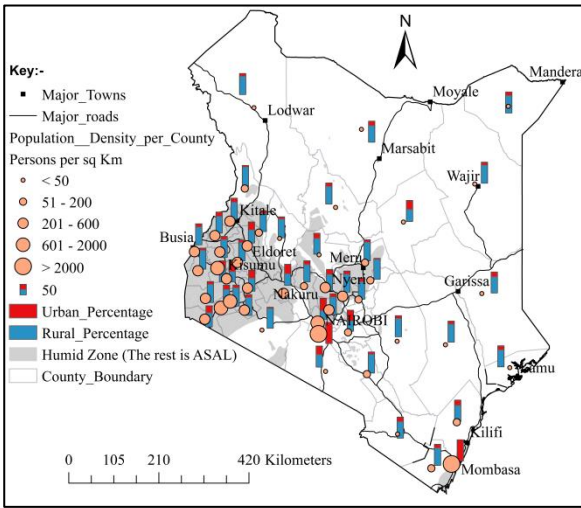


Fig.4 Settlement patterns

Residents of ASAL areas rarely practise crop cultivation. They are essentially nomadic pastoralists who move in search for food and water. Over 70% of national livestock are in these areas.

3. WATER SECTOR MANAGEMENT

(1) Overview

Water affairs sector in Kenya is headed by the Ministry of Water and Irrigation (MWI). It formulates policy, plans and mobilises resources for the sector. Fig. 5 is a representation of the sector management set up; more descriptive details are in sections (2) and (3) below. It is a top-down management system with national, regional and local institutions. The institutions have some level of autonomy in operations and decision making to cut down bureaucracy and improve performance and efficiency in service delivery. The ministry discharges its mandate in two ways: water resources and water services, both of which are managed separately but in a parallel manner. At national level the Water Resources Management Authority (WRMA) heads the water resources while Water Services Regulation Authority (WASREB) heads water services. At the regional level there are six WRMA regional units and eight Water Service Boards (WSBs). Their areas of operation are delimited based on basin boundaries of the main rivers. At the local level there are 517 Water Resource Users Associations (WRUAs) and 99 Water Service Providers (WSPs) on water resources and water services sections respectively^{14), 1)}. Each of the regional units manages the local units that fall under their respective area of jurisdiction.

There are other national institutions whose mandates are: Kenya Water Institute (KEWI) – carries out training and research; National Irrigation Board (NIB) - develops, improves and controls irrigation

schemes; Water Services Trust Fund (WSTF) - finances provision of water services to disadvantaged groups (pro-poor) as a water poverty fund; National Water Conservation and Pipeline Corporation (NWPC) – constructs dams and drills boreholes; Water Appeals Board (WAB) – arbitrates water-related disputes and conflicts between institutions and organisations.

This management system was enacted in 2002 when Kenya was ruled under the central government; but with a new constitution that was promulgated in 2010 that devolved provision of water services to county governments, Kenyan legislators are yet to pass new water laws that are attuned to the new constitution¹⁵⁾.

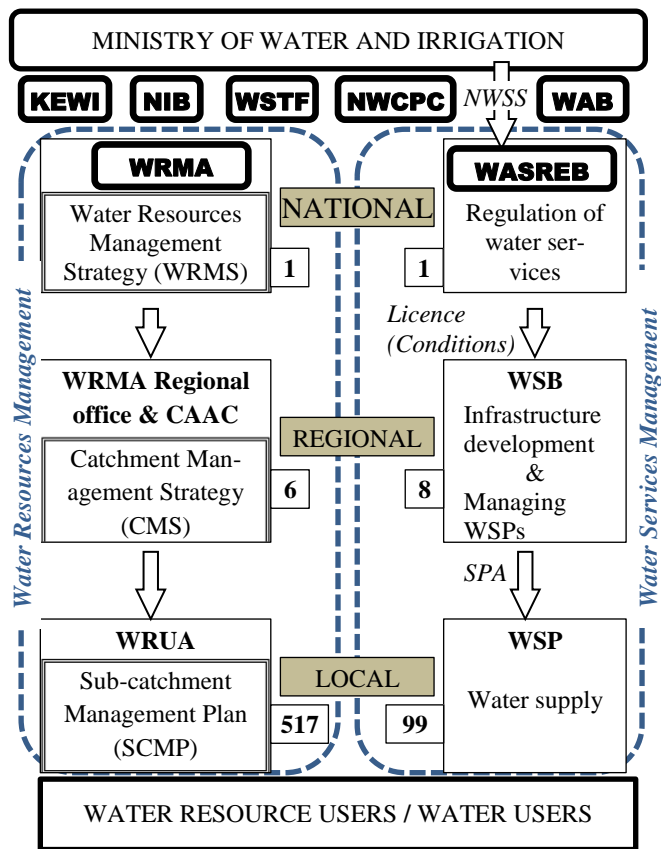


Fig.5 Kenya's water sector management structure.

(2) Management of Water Resources

Water Resource Management Authority (WRMA) is the national lead organisation that manages allocation of water resources to various users, determines conditions for water use permit and related charges, plans for conservation of water resources and maintains water resources data. It develops the National Water Resources Management Strategy (NWRMS) which outlines the strategy with which its mandate will be delivered¹⁶⁾.

At each of the six regional (catchment) levels there is WRMA regional office and Catchment Area Advisory Committee (CAAC). In consultation with

CAAC, WRMA regional office develops a Catchment Management Strategy (CMS) consistent with NWRMS¹⁶⁾. Further within each region, there are several Water Resource Users Associations (WRUAs) that are based at sub-catchment level. A WRUA is an association of water users, riparian land owners, non-consumptive members and observer members, who have formally and voluntarily associated for the purposes of cooperatively sharing, managing and conserving a common water resource. WRMA regional offices are fundamental in the process of forming a WRUA. WRUA prepares a Sub-Catchment Management Plan (SCMP), which is a document describing the water resource management problems within a sub-catchment and a set of prioritised activities aimed at solving the problems. The plan is produced in consultation with WRMA regional offices who guides according to the region's CMS. SCMPs are periodically updated and/or revised. The WRUAs can then make proposals and seek for direct funding of their proposed activities from government and/or other willing financiers. WSTF finances some SCMPs through WRUA Development Cycle (WDC).

(3) Management of the Water Services Sector

Fig.6 below shows the management of water services sector in Kenya. The MWI sets out the strategy of the water services sector through the National Water Services Strategy (NWSS) outlining current extent of services and an investment plan to reach underserved areas¹⁷⁾. In order to increase water supply coverage levels, the MWI, through the Water Service Boards (WSBs), plans and constructs water (and sanitation) facilities. It also develops dams and boreholes through NCPWC and water facilities aimed at the poor through WSTF.

The WSBs then assumes the ownership of the facilities and leases to Water Service Providers (WSPs) to run and manage them by supplying water, issuing bills and receiving revenues. They then use the collected revenue to manage their operations (1), pay lease fees to WSB (2a), regulatory fees to WASREB (2b) and abstraction fee to WRMA (2c). WSPs also service debts in instances where the MWI borrowed loans for developing water facilities that they run (3). Any revenue remaining after fulfilling all the mentioned obligations is earmarked for investment in system rehabilitation and expansion (4)¹⁸⁾. The government's underlying concept in this system was to commercialise the water services sector in order to improve efficiency in service provision and limit dependence on central government financing. Therefore for the WSPs whose revenue do not meet operation and maintenance (O&M) costs, the MWI has been trying to cluster several of them under one

WSP to improve prospects for commercial viability. In the meantime they receive support from MWI¹⁹⁾.

The law also provides for private water providers but their occurrence in reality is very minimal. WASREB reported of two private water service providers in their 2013-2014 report¹⁾.

The WASREB sets the regulations governing water services provision including service standards and tariff guidelines in line with the goals of NWSS and passes to WSBs in form of a licence, who then ensures WSPs adhere to these guidelines by entering into a Service Provision Agreement (SPA) with the WSPs.

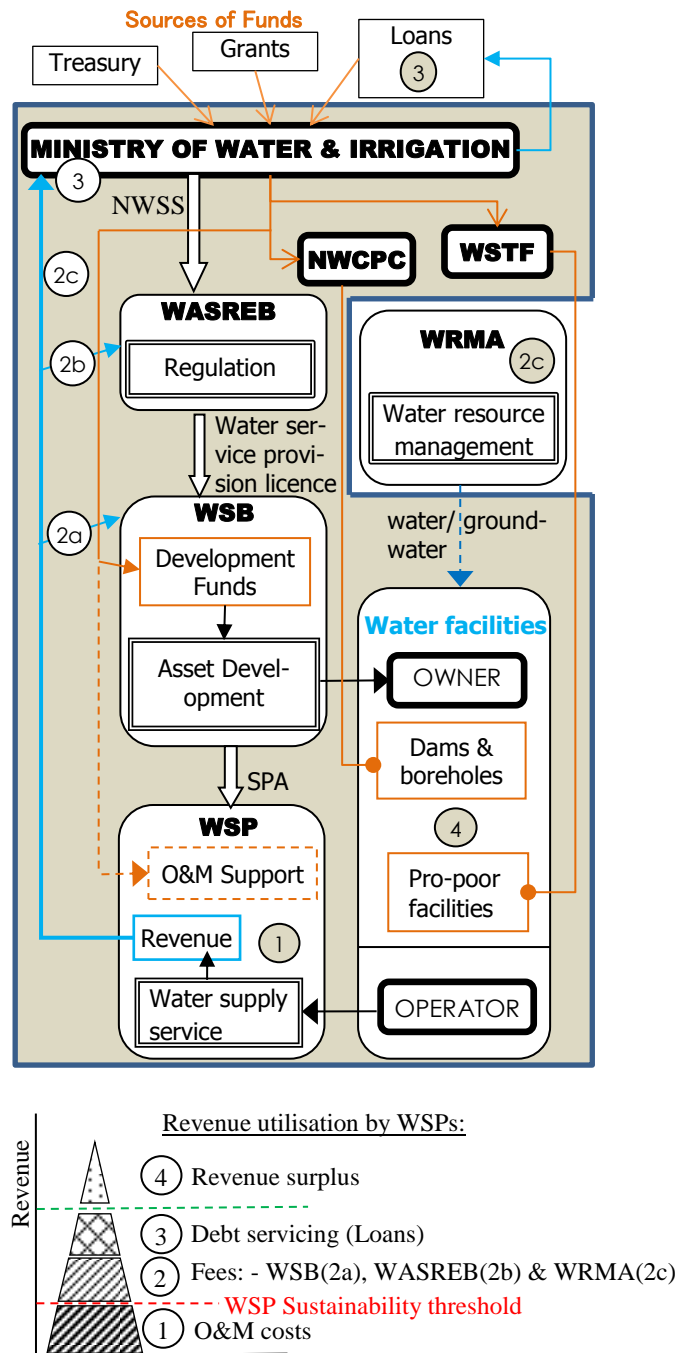


Fig.6 Management model for water services

4. WATER RESOURCES

(1) Sources

The humid zone supports montane forests which are water sources for Kenya's main rivers. With an average annual rainfall of over 2,000mm and a potential rainfall-runoff ratio of 65%, total water yield from these catchments is estimated to be more than 15,800 million m³/year, which is more than 75% of the renewable surface water resources of Kenya²⁰. The government of Kenya has identified, classified and mapped five key catchment areas where major rivers originate (termed as 'water towers') namely: Mt. Kenya, The Aberdares, Mau Forest Complex, Cherang'any Hills and Mt. Elgon (**Fig. 7, Table 5**). Apart from assuring water security, the ecosystem processes of the 'water towers' support the economy and livelihoods of the majority who are primarily natural resource dependent. Therefore any mismanagement of these towers has huge effects throughout the country²¹. Because of this importance the government set up the Kenya Water Towers Agency (KWTA) in 2012 to co-ordinate and oversee the protection, conservation and reclamation of forests in the catchment areas amongst thirteen other important but smaller watersheds.

Table 4 Water Resources in Kenya (2010 estimate)²²⁾

Surface water: x10 ⁶ m ³ per year (a)	20,637	
Ground water recharge, x10 ⁶ m ³ per year (b ₁)	21,470	
Ground water (safe yield), x10 ⁶ m ³ per year (≈9% of groundwater recharge) (b ₂)	1,927	
Total, x10 ⁶ m ³ per year (c) =(a)+(b)	42,107	22,564
Population, million people (d)	38.53	
Per capita renewable water resources, m ³ /capita/year {=(c)/(d)}	1,093	
Per capita available water resources, m ³ /capita/year {=(c)/(d)}	586	

Available freshwater resources index was 1,093m³/capita/year while water resources availability was 586m³/capita/year. It has been proposed that when annual per capita renewable water resources availability is below 1,000 cubic meters, water scarcity begins to hamper economic development and human health and well-being²³.

(2) Groundwater Condition

Fig. 8 shows the country's type and productivity of the main aquifers at a national scale mapped by British Geological Survey²⁴. The map has strong correlation with Kenyan government's data on the country's average groundwater yields. The 'low'

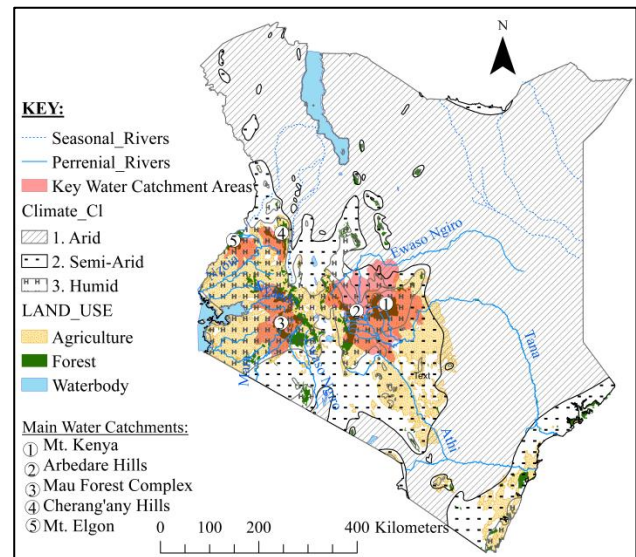


Fig.7 Main water catchment areas

Table 5 Condition of Main Water Catchment Areas^{7), 22), 25)}

Watershed name	Catchment Area (ha)	Max. Altitude (m)	Gazetted Forest Area (ha)	Main River
Mt. Kenya	1,253,959	5,199	203,145 4% cropland	Tana, Athi
Aberdare	1,097,895	4,001	104,078 11% cropland	Ewaso Ngiro, Athi
Mau Forest Complex	874,746	3,098	404,706 25% cropland	Mara, Nyando, Yala
Cherang'any Hills	212,267	3,365	120,841 19% cropland	Nzoia, Turkwell
Mt. Elgon	249,996	4,320	72,547 15% cropland	Nzoia, Turkwell

zones on map correspond to areas with yields less than 1litre/sec, 'moderate' zones to yields between 1 to 3 litres/sec and 'high' zones over 3litres/sec²⁶). In 2013, groundwater exploration of a 36,000km² zone in North Western Kenya (shaded area in **Fig. 8**) was commissioned by United Nations Educational, Scientific and Cultural Organization (UNESCO) in which a historic 250.335x10⁶ m³ water storage aquifer was discovered in Lodwar and Lotikipi basin aquifer systems whose yield varies between 7.5 – 27.0 litres/sec and recharge was estimated to be 3.447x10⁶ m³ per year²⁷). In Kenya deep aquifers are normally exploited through boreholes while shallow aquifers are through shallow wells. Currently there is no adequate data to assess the water quality distribution by regions. However, for the boreholes drilled, Lake Victoria, Rift Valley and Tana River basins (**Fig. 9**) have fresh water free from colour, turbidity and have acceptable salinity levels except Rift Valley

which has fluoride levels that tend to be higher than 1.5ppm, and most of the boreholes in Athi and Ewaso Ng'iro river basins that were reported to yield hard water²¹). There's sea water intrusion at the coastal area which affects groundwater quality.

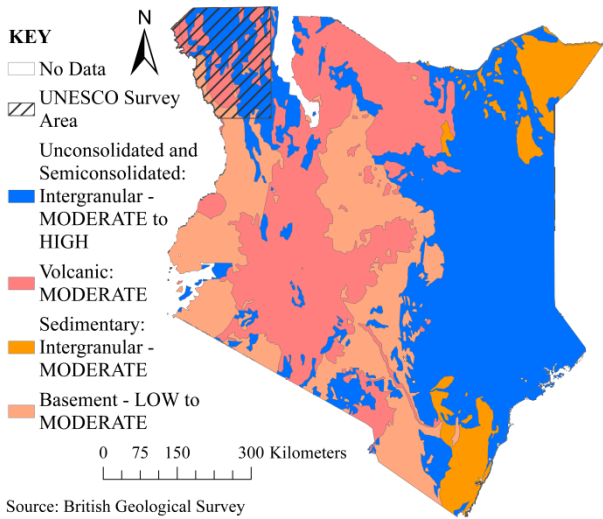


Fig.8 Hydrogeological map of Kenya

(3) Drainage Basins and their Characteristics

Kenya's drainage system is divided into five basin areas namely:

- i) Lake Victoria – it is the smallest in surface area but with the most abundant water resources due to high rainfall. It drains into Lake Victoria. It is part of the Nile River basin
- ii) Rift Valley – lies in the Great Rift Valley, between the East and West highlands of Kenya, and has series of dead Lakes with no outlets
- iii) Athi – Nairobi and Mombasa, country's two largest cities, are in this basin. The high population, coupled with low water resources result in a high water demand versus water resources ratio
- iv) Tana – had 45% of country's total irrigation area in 2010²²)
- v) Ewaso Ng'iro North

(4) Water Demand and Water Balance

Annual water demand was estimated to be 3,218 million m³ in 2010 which is 14% of the estimated available water resources. Groundwater supplied 16% of the demand. Almost half of the total demand was from irrigation sector despite being demand for only 17% of the potentially irrigable land. The low development is due to scarcity of water in most of the areas where irrigation development is highly suitable and the high costs of irrigation development¹⁰). The most common types of irrigation are flood and canal irrigation whose efficiencies can be as low as 30%²¹). The current available water resources base can de-

velop 62% of the 876.5million hectares of irrigable land¹⁰). The government aims to put 404,800 (46%) of the land under irrigation by 2017. Subsequently they plan to manage irrigation water demand by increasing water storage from current 5.3 m³ to at least 16 m³ per capita and increase water harvesting, conservation farming, drip/sprinkler irrigation, water conservation and storage at farm level. Electricity generation, though non-consumptive, was estimated to be using 13,946 million m³ annually. Hydro power accounts for 50 – 55% of electricity generation⁷).

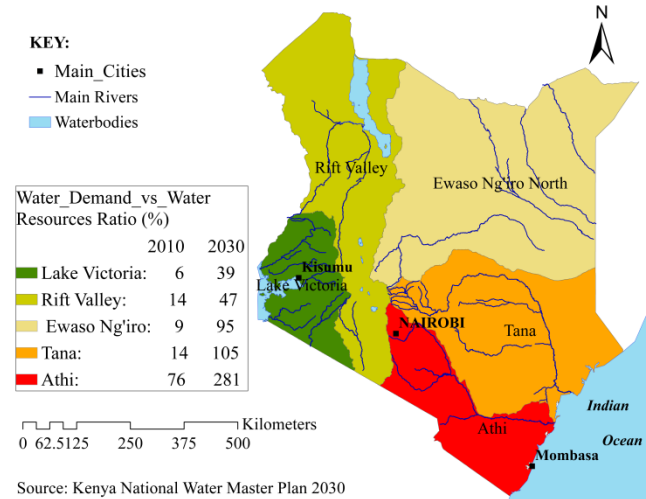


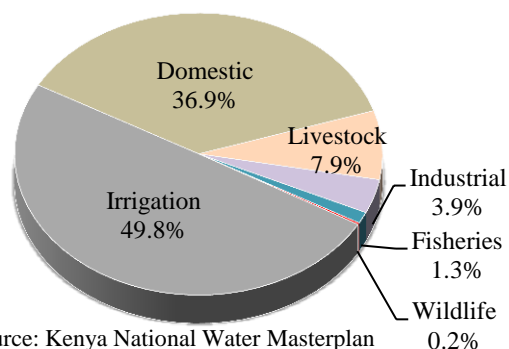
Fig.9 Water Basins and Water Balance

Table 6 Characteristics of Drainage Basins as at 2010²²)

Catchment Area	Water sources		Population		Area, ratio of Kenya's surface area (%)	Existing storage(dams & pans) (x10 ⁶ m ³)
	Volume (x10 ⁶ m ³ /year)	Re-Ratio (%)	Ratio of Total (%)	Density (/km ²)		
1. Lake Victoria	9,718	43	37.2	287	8.7	38
2. Rift Valley	2,559	11	12.6	37	22.7	1,665
3. Athi	1,503	7	25.4	167	10.2	22
4. Tana	6,533	29	14.9	45	21.9	2,277
5. Ewaso Ng'iro N.	2,251	10	9.9	18	36.5	10
TOTAL	22,564	100	100	67	100	4,012

(5) Transboundary water resources

It is estimated that Kenya shares over 50 percent of its water resources with neighbouring countries⁸). Transboundary water policy was recently approved¹⁴). However, the accurate knowledge of the state of the water resources within the shared basins and the probable future demands by neighbour countries has not been established. Table 7 shows the water resources that Kenya shares with the neighbouring countries.



Source: Kenya National Water Masterplan

Fig.10 Annual Water Demand Estimates as at 2010

Table 7 Transboundary water resources⁸⁾

Type of Water Body	Shared with	
A. Lakes	1. L. Victoria	Uganda & Tanzania
	2. L. Turkana	Ethiopia
	3. L. Jipe 4. L. Chala	Tanzania
B. Rivers	1. R. Sio 2. R. Malakisi	Uganda
	3. R. Malaba 4. R. Suam	
	5. R. Mara 6. R. Uмба	Tanzania
	7. R. Daua 8. R. Omo	Ethiopia
C. Aquifers	1. Merti aquifer	Somalia

5. WATER SERVICES PROVISION

(1) Background

The government aims to achieve 100% water supply coverage countrywide by 2030 in order to achieve its vision 2030 development goals and to fulfil constitutional rights for its citizens of access to clean and safe water in adequate quantities^{2), 28)}. As aforementioned, the MWI sets out the strategy of the water services sector through the NWSS outlining current extent of services and an investment plan to reach underserved areas. Its approach to the sector is mainly twofold: urban (including the urban poor) and rural, which both have different features (**Table 8**).

(2) Current Water Situation

Nationally water supply coverage stood at 52.6% in 2009 (**Table 9**). Urban areas had more coverage (71.7%) compared to rural area where more than half of the population (56%) get water from un-protected sources. Piped water (piped & piped into dwelling) is the main source of water for urban residents while streams/rivers are the main sources for the majority (29.6%) in rural areas. Water availability in the streams/rivers varies with location depending on climate. The wet areas (humid zone) experiences water scarcity during the three driest months of the year while ASAL areas experience it throughout the year. Approximately one-third of Kenyan households use groundwater.

Table 8 Main characteristics of urban and rural water users^{5), 22)}

Category Feature	Urban		Rural
	Urban Poor	Urban, Other	
Geographical location	Urban	Urban	Rural
population density	Very dense	Dense	Sparse to very sparse
Socio-economic status	Very poor	Medium to wealthy	Poor to wealthy
Main sources of water	Water kiosks, water vendors	Piped systems to houses, yard taps	streams, borehole & wells, springs and small-scale piped systems
Main water operator	Formal WSP, water vendors	Formal WSP	Informal WSP, individual/community

Table 9 Access to water by households by type of source (%)²⁹⁾

Source	Kenya	Urban	Rural
Stream/River	23.2	9.2	29.6
Unprotected Well	6.9	2.9	8.7
Water vendor	5.2	11.8	2.2
Unprotected Spring	5.0	1.9	6.4
Pond	2.7	0.9	3.6
Dam	2.4	0.7	3.2
Lake	1.2	0.5	1.5
Jabia	0.3	0.2	0.4
Other	0.4	0.1	0.5
Total Unimproved Sources	47.4	28.3	56
Piped	19.2	34.9	12.1
Borehole	11.6	10.7	12
Protected Well	7.7	6.8	8.1
Protected Spring	7.6	4	9.2
Piped into Dwelling	5.9	14.7	1.8
Rainwater Collection	0.7	0.5	0.8
Total Improved Sources	52.6	71.7	44
TOTAL	100	100	100

A study by Munguti et al³⁰⁾ in urban and rural Kenya showed that approximately 85% of household water usage is in cooking (& drinking), washing and bathing. Urban dwellers tend to use about twice as much water as rural residents, and households with piped connections (mostly in urban areas) use, on average, three times more water than those without. This can be attributed to the convenience of the source of water. For the same reason, households with un-piped water prioritise water for drinking and

cooking at the expense of other uses. Access to piped water in informal settlements (urban poor), whether in home or compound, have service for at least as many days per week as those in formal, implying that there is equitable water supply distribution in most urban areas³¹⁾.

(3) Urban Water Supply

Water services in urban areas are provided by urban Water Service Providers (WSPs). The WSPs have entered into formal regulation by WASREB as was outlined in Fig. 6. WASREB is therefore able to track and report on these WSPs. Table 10 below shows the status for 91 urban WSPs as reported in WASREB's latest report for 2013/14. In general urban areas have the advantage of benefits resulting from economies of large scale due to the concentrated demand for water from urban dwellers and industries. Therefore commercialisation is rather a straightforward process compared to rural areas.

Table 10 Performance of urban WSPs in 2013/14¹⁾

General		
Total Urban WSPs (count)		99
Urban centres served (count)		653
Total population in WSP area (million people)		19.8
Population served (million people)		10.5
Average consumption (litres/capita/day)		33
Indicators	2013/14 average	Recommended
Water coverage, population (%)	53	> 80
Water quality standards – compliance with standards (%)	91	> 90
Hours of supply (hours/day)*	18	> 12
Non-Revenue Water, NRW (%)	42	< 25
Metering Ratio (%)	89	> 95
Staff productivity (number of staff per 1000 connections)	7	< 14
Personnel expenditure as % of O&M costs (%)	42	< 45
O&M cost coverage (%)	100	100

It can be seen from this table that water coverage, NRW and metering ratio are below the standards set by WASREB. The average O&M cost coverage is 100% implying that all the WSPs are able to meet their operation and maintenance costs from the revenues generated and therefore require no O&M support from the government. The O&M breakdown for 2014 is: personnel (39.1%), levies and fees (11.7%), electricity and chemicals (9.3%) and others (39.9%) – maintenance costs, general administration costs, board meetings expenses and other direct operational expenditure. The WSPs serve 10.5 million people which is approximately 85% of urban, or 25%

of the country's population. Majority of the water supply schemes get water from surface sources located in rural areas surrounding the urban supply area.

(4) Rural Water Supply

Rural areas are characterised by dispersed settlements making it costly to invest in a piped network system. Majority of the sources therefore are point sources. 40% of the households in rural areas use more than 30min for round trip to obtain drinking water from source. Females aged over fifteen years are responsible for fetching water in 60% of rural households³²⁾. The condition is worse for ASAL areas where there are few water resources coupled with low population densities. As seen in Table 9, 56% of rural water sources are unimproved implying that over half of rural population depend on natural processes and homemade solutions for water purification.

Facilities developed in rural areas are normally small scale and of low sophistication. They are handed to the community groups concerned and are only required to meet operation and maintenance costs unlike the urban set up³³⁾. Those connected in most cases are not metered and pay a flat rate every month. The money collected usually is little and cover operation costs only and thus require WSB's assistance during maintenance³⁴⁾. The WSB undertakes continuous capacity building to the project management committee of rural projects so that they can manage the facility perpetually by themselves. In most cases it is not feasible to establish a service provision model akin to one in an urban setting unless there is a possibility of clustering several water supply schemes under one WSP to enable realisation of synergies and economies of scale and thus improve prospects for commercial viability. Therefore the government has adopted "community-based and demand-driven but open for commercialisation wherever possible"¹⁷⁾ approach to rural water supply. For the meantime there's less formal monitoring and regulation of rural water supplies.

In the remaining areas where no WSP has yet been identified, services are operated by the WSBs on an interim basis, or provided by associations or community based organisations¹⁹⁾. Some institutions like churches also construct small scale facilities and assist the community continuously in running and managing the facility.

(5) Pro-Poor Strategy in Water Services Provision

Urban poor live in low-income areas within the jurisdiction of formal regulated WSPs. Due to the densification and lack of planned development, providing them with individual service connections

poses a challenge. Water kiosks therefore emerge as an appropriate means to serve urban poor howbeit accessibility cannot be ascertained (basic access is defined as 20 litres per person per day³⁵). WASREB protects consumers against overpricing through regulation of WSPs' tariffs. They limit tariffs to not more than 5% of a household income³⁵. Through the WSTF, projects for rural and urban poor are implemented through Community Project Cycle (CPC) and Urban Poor Concept (UPC) respectively. CPC and UPC are systems for accessing and using funds for water and sanitation projects. CPC was the first to be rolled out in 2007 and has benefitted 687,302 people to date. It is reported to be successful³⁶.

6. KEY CHALLENGES IN THE SECTOR

(1) Causes and Interrelationship of Challenges

Fig.11 shows the genesis and evolution of the main problems affecting increased water supply coverage in Kenya. Other than low water coverage, the other resultant effects are low irrigation development and low water service provision standards.

The level of funding of the water sector is below the level required to meet the growing demand for water. Annual budget for the sector is approximately 2.8% of the national budget, which is estimated to cover around 44% of the required investment cost²². The resulting funding gap is partly financed by donors. Donor financing in the ministry ranged between 55 - 65% of the ministry's total annual budget in 2010 - 2014 period. Pro-poor fund managed by WSTF ranged between 1 to 3% of the ministry's annual budget in 2005 - 2010 period^{22, 37}. This implies that rural areas, where 68% of poor live, receive low government investment. This can be partly attributed to the borrowing of funds for investment which makes return on investment a priority factor in investment targeting process. Therefore poor areas with low Ability to Pay (ATP) and Willingness to Pay (WTP) get a lower priority. Inadequate funding for conservation measures for water resources further leads to gradual decline in quality and quantity of water from the sources.

Relative high cost of O&M compared to revenue is the main cause of unsustainability of water systems. With a commercialised water sector, the WSPs running water supply systems that do not break-even find it difficult to carry out routine maintenance and to hire and retain competent staff due to insufficient revenue. This leads to slow decay of infrastructure and consequently a decrease in the number of customers reached and a decline in quality of services, which then results in a falling revenue generation. This cyclic trend is greatly exacerbated by

Non-Revenue Water (NRW) because it is a direct loss of potential revenue by the WSP. High O&M cost is associated with any of the following factors:

- 1) Initial choice of intervention – lack of adequate information leads to overdesign, under design or inappropriate choice of technology in interventions, which lead to high unit operation and/or maintenance costs
- 2) Poor management practices – these are practices in the management of water supply systems that do not conform to standard corporate governance code. It results in incurrence of unsustainable costs. Examples include poor control of finances, lack of transparency, overemployment, etc. Rural water supplies are more prone to this problem because they are less monitored by WASREB.
- 3) Water sources carrying high sediment load due to catchment degradation makes it expensive to treat the water and to maintain the raw water facilities and reservoirs.

The challenge of catchment degradation is complicated by the dilemma between sustenance of human livelihoods vis-a-vis sustainable use of the ecosystem. Most of the anthropogenic activities like agriculture which are sources of livelihoods coincidentally thrive in critical catchment areas. These activities tamper with soil cover thus causing erosion and increases rainfall runoff hence slowing down infiltration rate which reduces groundwater recharge. This negatively affects availability of water especially for the irrigation sector which is a major user.

The growing population and the subsequent socio-economic development including urbanisation, industrial production, tourism and agricultural activities, cause an increasing demand for water. With the country having uneven water resources distribution, conflicting interests arise amongst the various water users. Conflicts also arise between adjacent communities, especially in rural areas, when water facilities are developed in an unequal manner. Ethnicity-related conflicts have arisen under such circumstances. A similar form of conflict arises when a water source is developed to benefit other users elsewhere, whether urban or rural, without any direct benefit to the residents living within the surrounding area of the water source.

Lack of involvement of stakeholders in the development, use and management of water sustains a continued state of unreconciled interests and expectations amongst water users. The ensuing conflicts and lack of sense of ownership of projects wanes the peoples' support for water projects, resulting in low social acceptance, thus dragging the improvement of water situation.

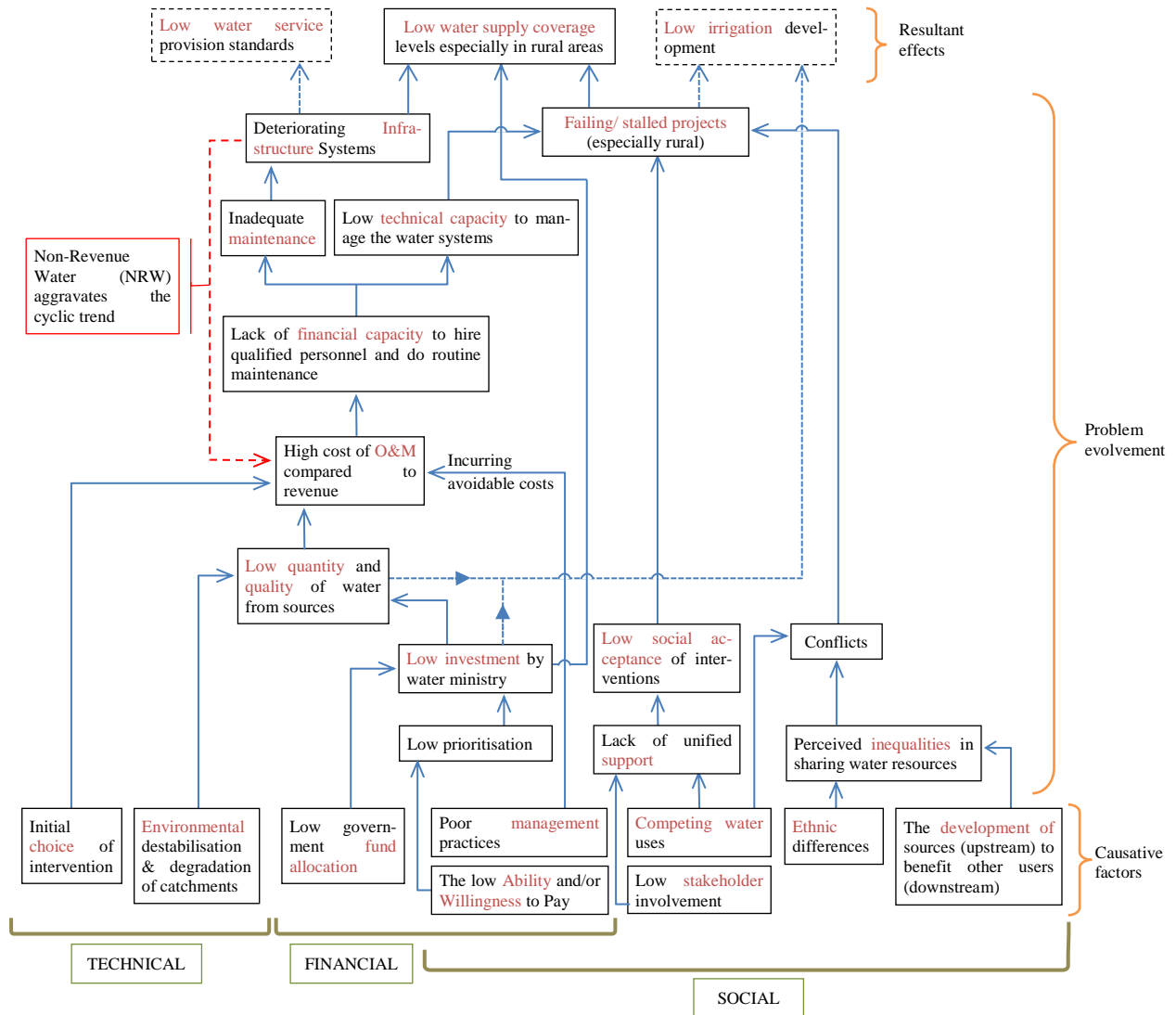


Fig.11 Diagrammatic representation of the factors affecting water supply coverage in Kenya

(2) Proposing a Solution Strategy

An Analysis of the challenges reveals that the evolvement of the causative factors hinge on the strategic aspects discussed below. Possible counter-responses to improve the current situation are proposed.

1. *National Planning:* Presently development plans are largely developed by the water sector institutions, with each focusing on it area of mandate. Adopting a consistent integrated national master plan for the entire sector, that is based on principles of equality and aimed at poverty alleviation and improvement of health and living conditions will help in bringing an even development hence alleviating conflicts. For accurate and robust master plan, an understanding of the trends and relationships between variables in the sector is necessary. This can be achieved through continuous studies and research on the performance of the sector, which is discussed in (3) below.
2. *Monitoring:* A national monitoring framework

needs to be developed to measure the performance of the sector towards achievement of its goals at national and local levels, and to evaluate its consistency with the sector master plan, and water resources and water services strategies. The findings could then be used to form a basis for appropriate adjustment to the national plans. This calls for filling the existing information gaps in water resources and water services.

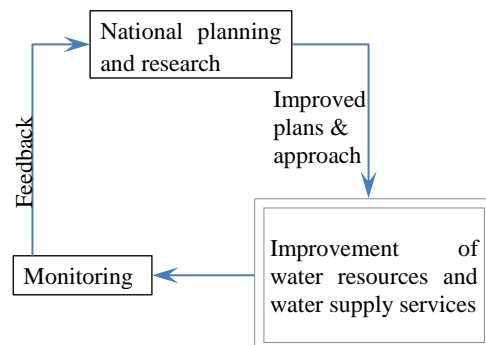


Fig.12 Monitoring strategy

3. *Continuous Planning and Research*: The aim of this strategy is to encourage innovation of low-cost technologies, and to embrace continuous improvement of the sector by using research findings to improve the prevailing situation. The ministry has a training and research institution (KEWI) though it mainly concentrates on training.
4. *Water Resources Conservation and Management*: The critical issue at present is the lack of sufficient information on both national and trans-boundary water resources. It is therefore necessary to develop systems for data collection and monitoring. Adequate and accurate data is required to clearly understand the variation of quality and quantity of water resources in space and time, and their relationship and interaction with other variables like climate, landcover/landuse, geological formation, etc. This information is necessary for effective water resources management and planning of conservation measures.
5. *Project Cycle Approach*: This is a proposed framework for involving all relevant stakeholders in all project phases starting from inception, planning, design, implementation up to operation phase, in all interventions of the sector. The aim is: (1) for those planning, designing and implementing the projects to be able to understand and accurately assess the needs of target beneficiaries, and to provide a platform for skills transfer, and (2) for the target beneficiaries to subscribe to the ideas proposed in project interventions and to receive the necessary skills to manage them; especially in the case where the beneficiaries are ultimately required to manage the project by themselves like in most rural water supplies. The current CPC approach framework employed by WSTF has yielded positive results in project acceptance by the locals especially in rural areas. Therefore it can be used as a basis for developing a universal approach framework to project implementation in the sector. This kind of approach improves the relations between the ministry and target beneficiaries, and also in-between the beneficiary communities themselves, thereby reducing conflicts while fostering understanding of the project.
6. *Sustainability*: In order to ensure sustainability of water supplies, it emerges from the analysis that the following three factors have direct primary effects on sustainability and they need to be addressed:
 - 1) Improving water quality and quantity through water resources conservation
 - 2) Initial choice of intervention – it is proposed

- that guidelines on the sequence of activities to be followed in project planning, design and implementation be developed for those offering professional services to the water sector. In these guidelines the water ministry can address the following issues amongst others:
- a. Adoption of findings from research and studies of the sector
 - b. Adoption of a Project Cycle Approach – The aim is to ensure planners, designers and project implementers gain an accurate understanding of stakeholders’ views and perceptions.
 - c. Recommendation of manuals, standards, and other necessary documents to be adopted in the assignment process.
- 3) *Management practices* – this requires setting of governance standards and enforcing them in management of water supplies. For this reason the rural sub-sector needs to be brought into formal monitoring and regulation just like the urban sector. The involvement of stakeholders as afore discussed play a critical role in embracing of best practices in the management of water supplies.
 7. *Funding*: There is need to increase funding of the sector to realise the water goals which will aid the country’s development plan as contained in the Kenya Vision 2030. It is also necessary to develop a mechanism for allocation of funding (from government & donors) to rural and urban water supplies that guarantee parity so that constitutional requirement of access to safe water in adequate quantities by all citizens is achieved. Because of the limited government resources, it is proposed to prioritise activities as below:

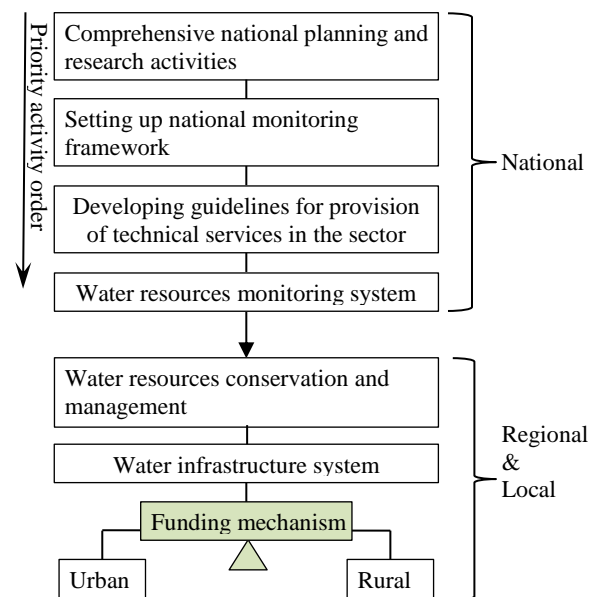


Fig.13 Funding - solution strategy

7. CONCLUSION

The study of the water situation in Kenya revealed the root factors for continued low water supply coverage to be: choice of intervention, environmental destabilisation and degradation of catchments, low government funding, poor management practices, low ability and willingness to pay, low stakeholder involvement and conflicts caused by competing water uses, ethnic differences and unequal development. As these factors evolve they conjoin into common interrelated higher order problems, which are: sustainability of water supplies due to high operation and maintenance costs compared to revenue earnings, low investment in the sector, low social acceptance of interventions and conflicts. All these finally lead to low water supply coverage, and other problems like low water service provision standards and low irrigation levels.

The analysis showed that this can be curbed through a strategy that targets the following:

- Planning based on principles of equality and poverty alleviation.
- Continuous study and research on the sector to gain understanding, hence providing a basis for stepwise improvement of the plans.
- Monitoring of the sector to track performance and provide a basis for adjusting plans.
- Adopting sustainability strategies so that implemented projects keep running as designed.
- Changing the approach of implementing projects in the sector by involving stakeholders in all stages so as to foster social acceptance.
- Laying out of strategy for collection of information for water resources to guide during planning for management and conservation
- Developing a funding strategy in which planning activities are prioritised, and emphasis put on parity between urban and rural water supply development.

It is also deduced that the implementation of these strategies falls within the jurisdiction of the ministry in charge of water affairs with a few exceptions: the low funding which depends on national budgeting; catchment conservation which cuts across other government departments like environment; and ethnicity which requires a national multifaceted solution strategy. Notwithstanding this, great strides towards the vision 2030 target of 100% water supply coverage could be made in the sector if the proposed strategies were to be adopted. Moreover, implementation of most of the strategies requires neither enormous financial resources nor major restructuring; hence they could be easily adopted.

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