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WATER REFORMS IN KENYA: A HISTORICAL CHALLENGE TO ENSURE UNIVERSAL WATER ACCESS AND MEET THE MILLENNIUM DEVELOPMENT GOALS

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WATER REFORMS IN KENYA: A HISTORICAL CHALLENGE TO ENSURE UNIVERSAL WATER ACCESS AND MEET THE MILLENNIUM DEVELOPMENT GOAL

A DISSERTATION APPROVED FOR THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL SUSTAINABILITY

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Abstract

Access to water is a key issue for developing countries. Kenya is one such country in which water scarcity and a poor water infrastructure compromise the health and standard of living of the population, and hinder its economic and social development. Despite a long history of attempts to reform the country's water sector and improve water resources management, a large proportion of Kenya's population is still not sufficiently served with water for consumptive, sanitation, and productive purposes. This dissertation examines aspects of water reform and access in the country, including the institutional and historical factors affecting the water sector, and the historical evolution of water resources management from the colonial to post-independence periods. The most recent reform (2002) is assessed in terms of its effectiveness in bringing about institutional reform, as well as the operating performance of water service providers in meeting the Millennium Development Goals (MDGs).

The study adopts a case study approach using mixed methods. Specifically, a questionnaire was administered to the newly formed Water Service Providers (WSPs) as well as various water sectors. The performance efficiency of the WSPs was analyzed using data envelopement analysis. The results reveal that continuing duplication of functions across the water sectors, low levels of funding, and corruptions are inhibiting the effectiveness of the restructuring. The greatest challenge in executing the reforms

relates to the financing of the whole process. While the relevant policies and institutions have been set up, they lack funds either to support the planned activities, and projects or, importantly, to raise the performance of existing WSPs. The study uncovered that, by pegging its initiatives on global targets and foreign aid, Kenya has changed its policies and institutions to reflect the global trends several times. This has led to weak or lack of continuity in policy, and reform process in the country. Furthermore, linkages among the several agencies dealing with water services remain weak, and water resource policy has not been harmonized with sanitation policy, irrigation policy, and environmental policy.

The study has further shown that while the 2000 reforms have resulted in major gains in policy reforms, significant improvement in water access will not be achieved without addressing the systematic inequalities of water access caused by land alienation during the colonial rule. After independence, most of the land owned by the Europeans was not returned to the natives, but rather bought by the rich or converted to game reserves. In this case, the land tenure system that broadly disenfranchised the local population before independence continues to date.

The study shows that the WSPs created to replace the government agencies in the provision of water services are not efficient and productive enough to meet the MDGs as envisioned by government plan. The implications and recommendations for water sector performance relate mainly to these WSPs. While the companies are still young and need time to mature, some challenges need to be addressed immediately.

Many WSPs still lose more than 50% of water as unaccounted-for-water. This is mainly due to a dilapidated infrastructure most of which was developed during the colonial period. Most of the pipeline systems, especially in urban areas, need to be replaced before extending coverage to other areas. In the absence of more (e.g., private sector) funding, this is unlikely to happen. Possible solutions include amalgamating smaller WSPs to increase their scale of operation. The study further outlined how some of the inefficiencies could be mitigated through benchmarking process. Weaker companies should be encouraged to emulate their benchmarked peers within the country, while stronger companies should be benchmarked with stronger companies in eastern Africa.

Chapter One: The Importance of Access to Water

1.1 Introduction

Water needs permeate all aspects of human existence and activity, and its availability has a significant bearing on the state of a country's development. The World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002 (Lenton, 2003), specifically identified water as the pre-eminent variable among the five WEHAB factors (Water, Energy, Health, Agriculture, and Bio-diversity) that require priority attention in sustainable development and in the alleviation of poverty. More recently, the *Third World Water Assessment Report* (UNESCO, 2009), reiterated United Nation Educational, Scientific and Cultural Organization's (UNESCO) long-held position that, in resource-based economies, inadequate water supply compromises the viability of key development sectors, including those of agriculture, health, energy, industry, and ecosystem.

Many developing nations, particularly those in Africa, suffer from poorly developed or inadequate water infrastructure, compromising their standards of living and prospects of further development (World Bank, 2005). In these countries, water scarcity (defined in section 2.2) and a lack of water storage infrastructure have been blamed for persistent poverty due to unpredictable food production, poor health, and unreliable electricity supplies, making development planning in these countries a constant gamble on rain (World Bank, 2005; Magoka et al. 2006). Kenya is one such country in which water scarcity and a poor water infrastructure compromise the health and standard of living of the population, and hinder its economic and social development. Despite a long history of attempts to reform the country's water sector and improve water resources management, a large proportion of Kenya's population is still not sufficiently served with water for consumptive, sanitation, and productive purposes. Access to water, is of paramount importance for a wide range of reasons, and the following sections elucidate the nature and dynamics of these connections.

1.2 Water, Poverty, and Development

Inadequate water availability exacerbates and confounds efforts to ensure food security, promote economic development, improve public health, and fight poverty. Poverty is a multi-dimensional deprivation affecting economic, health-related, psychological, socio-cultural, legal, and political facets of well-being (Schreiner & Van Koppen, 2002). Poverty is closely intertwined with water availability and use (UNESCO, 2009). Majority of people living under acute poverty (defined as those living on less than $1 a day) coincide closely to those without access to safe drinking water and sanitation services (GWP, 2003; Rijsberman, 2006). Consequently, some scholars (Harvey, 2008; Biltonen & Dalton, 2003) have argued that water access plays the most important role in the fight against poverty. Lack of water and poor sanitation poses a major challenge to efforts to fight poverty and accelerate development in most developing countries, because such countries rely heavily on natural resource-based activities (especially agriculture and tourism), which in turn depend critically on water availability (Falkenmark, 1990).

Constraints on water availability also compromise the ability to achieve the United Nation's (UN) Millenium Development Goals (MDGs). The MDGs are time-bound targets meant to steer the world out of poverty by the year 2015, through unified global efforts in education, health, environment, and economics (UN, 2000). Goal 7, target 10 of the MDGs seeks to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by the end of 2015 (http://www.undp.org/mdg/basics.shtml).

1.2.1 Water and agriculture

The influence of water on agriculture has been recognized for many centuries. In the dry areas of the Middle East, North Africa, and South West Asia, underground water systems were built to supply drinking and irrigation water as early as 1000 B.C. These systems, refered to as *qanats* (in the present day Iraq and Iran), *Karez* (in Pakistan, Afghanistan and western China), *Falaj* (in Oman), and *foggaras* (in Morocco and Cyprus) consisted of large wells (Mother wells) connected to a series of underground tunnels (up to 45 km long) that delivered water by gravity to nearby villages and farms (Cech, 2010). These ancient systems were so effective that they are still utilized in many parts of the world including Sulaimaniya in Iraq where *qanats* serve a population of 400, 000 people. Nearby Iran has 22,000 qanats still in operation (Cech, 2010).

Early civilizations in Egypt, Mesopotamia, China, India, and Mesoamerica developed along major rivers and harnessed water for irrigation. For example, over 6000 years ago, farmers in Mesopotamia dug canals to divert water from the Euphrates River to irrigate wheat and barley in the drier areas of the Tigris-Euphrates Valley (Gleick, 1993). To sustain the numerous irrigation projects, strong social and legal institutions were instituted. These institutions, among other functions, organized labor (including forced labor) to work on irrigation canals and farms, and enforced tax laws. Taxes were collected from farmers and strict laws were enacted to ensure the smooth operation of the irrigation systems. The code of Hammurabi, for example, required all farmers to maintain their canals to prevent flooding and subsequent damage to crops, and penalties were applied if damage was caused to neighbors' fields (Cech, 2010). Part of the code states that, "if a man has released water and so has let water carry away the works on his neighbor's field, he shall pay 10 gur (unit of measurement) of corn for every bur (unit of land) flooded" (Cech, 2010, p 251). The success of their agricultural production lasted for about 2000 years, after which salinization made the farms sterile, partly contributing to the collapse of the civilization (Postel, 2001).

In modern times, the success of the Green Revolution of the twentieth century in large parts of the developed world is credited mostly with the introduction of advanced irrigation technologies, which accelerated the expansion of irrigated land in developed countries from 94 million hectares in 1950 to 230 million hectares in 1980 (Gleick , 1993). Dams and canals built during this period transformed some of the driest lands in western United States into productive agricultural lands and flourishing cities. These include the 1.5 million acre feet/year capacity Central Arizona Water Project initiated in 1968 and completed in 1973, and the 11 million acre feet/year[1] California Central Valley Project started in the late 1930s and completed in 1970 (Gollehon & Quinby, 2000; Gleick, 1993).

In the twenty-first century, agriculture remains the biggest consumer of water, using a global average of 70% of all fresh water withdrawn from lakes, rivers, and aquifers (UNESCO, 2009). If current projections prove correct, then the proportion of water devoted to agriculture might rise further in coming decades. According to the Food and Agriculture Organization (FAO, 2002), irrigated agriculture is expected to increase in area in developing countries by 16% (

from 202 million hectares in 1999 to 242 million hectares by 2030). This will exert additional stress on available water resources, especially in developing countries, which are projected to account for over 50% of the additional irrigation water consumption (FAO, 2002; de Fraiture & Wichelns, 2010).

More than 70% of poor and hungry people in developing countries live in rural areas and depend directly or indirectly on agriculture (WEHAB, 2002). The incidence of poverty in these areas is much higher than in the urban areas of the same countries. In East Asia (excluding China), for example, the ratio of rural: urban poverty increased from 2:1 to 3.5:1 between 1993 and 2002 (World Bank, 2007). To reverse this trend, it has been argued that strong agricultural development is needed to ensure food security,

[1] Volume of water (equivalent to 43,560 cubic feet) that will cover an area of one acre to a depth of one foot

employment, foreign exchange earnings, and to boost agro-processing and non-agricultural industries (World Bank, 2007; de Fraiture & Wichelns, 2010). Rapid expansion of agriculture in China is attributed to a reduction in rural poverty level from over 50% in 1981 to less than 10% in 2001(Huang, et al., 2006; Ravallion & Chen, 2007). During the same period, 81% of the global reduction in poverty was attributed to improved agriculture (World Bank, 2007). In fact, research findings show that GDP growth from agriculture is much more effective in reducing poverty than is growth in other sectors such as manufacturing and tourism. For example, in their study of 42 developing countries between 1981 and 2003, Ligon & Sodoulet (2007) found that a 1% GDP increase originating from agriculture is 2.5 times more effective than other sectors in increasing the incomes of the poor, and for Latin America, Bravo-Ortega & Lederman (2005) found it to be 2.9 times more effective.

Studies in Africa also have found a direct correlation between irrigation and poverty. A study conducted in small-scale irrigation in villages in Burkina Faso, Mali, and Tanzania, found that irrigation projects not only reduced poverty rates by an average rate of 25%, but also led to a reduction in water-related diseases, including stunted growth, diarrhea, and malnutrition (UNESCO-WWAP, 2003; World Bank, 2005).

1.2.2 Water and Health

When people lack water for domestic or productive purposes, their livelihood is constrained by ill health. Access to safe and adequate water, adequate sanitation services, and good hygiene are the most efficient way of improving human health

(UNESCO-WWAP, 2003; UNESCO, 2009). During the industrial revolution in Europe, water- related diseases frequently threatened the successes recorded during industrialization (UNDP, 2006). Diarrhea, dysentery, and typhoid fever accounted for 1 in 10 deaths in American cities, while infant mortality attributed to water and sanitation accounted for 180 deaths for every 1000 births during the early nineteen century (Cain & Rotella, 2001).The rate in Birmingham and Liverpool, Britain, was 160 deaths for every 1000 births (Woods, Watterson, & Woodward, 1988). Developments in new technology, adequate finance, and political will, brought water and sanitation to the top of the agenda and reversed this trend (UNDP, 2006). However, the situation is different in the developing world. Whereas the global estimate of water-related diseases is that they constitute about 10% of all diseases (UNESCO, 2009), the average in developing countries is as high as 80%. These diseases include sickness from drinking contaminated water (waterborne-diseases), those stemming from water acting as a breeding ground for carriers (water-vector or water-based diseases), and diseases caused by a lack of proper cleanliness or hygienic washing (so-called water-washed diseases). Some of the diseases are presented on (Table 1.1).

Table 1.1: Major Diseases associated with lack of water and poor sanitation.

	Annual global burden attributable to water, sanitation, and hygiene	
Disease	Deaths (thouands)	DALLY[2] (in thousands)
Diarrhoea	1523	52,460
Malnutrition	863	35,579
Malaria	526	19,241
Lymphatic Filariasis	0	3,784
Intestinal nemanodes	12	2,948
Trachoma	0	2,320
Schstosomiasis	15	1,698
Japanese encephalitis	13	671
Dengue	18	586

Source: (UNESCO, 2009)

Ingestion of pathogen-contaminated water is the primary cause of diarrhea and amebiasis. Diarrhea, (mainly caused by ingestion of certain viruses, bacteria, or parasites present in water) causes considerable dehydration which may quickly cause death. Approximately 1.5 million people die each year from diarrhea (often occurring in conjunction with cholera), its debilitating effects making it the highest contributor to low productivity within the labor force in most developing countries (Kaler, 2008). Amebiasis is a diarrheal disease which occurs when pathogens invade the intestines, causing dysentery. The disease has been recognized as one of the most infectious in developing countries, causing 400 million infections and 30,000 deaths annually (WHO, 2008).

Water-based diseases occur through contact with aquatic organisms that live in water and require water as part of their life cycle, or are spread by insects that breed and bite near water. Chief among these is malaria, which kills over 526,000 people every

[2] DALLY is the disability-adjusted life years; the higher the number, the worse the quality of life in health terms

year and contributes to significant economic slowdown in most African countries (WHO, 2008). Gallup & Jefferey (2001) found that countries with severe incidence of malaria had a 1.3% lower economic growth rate compared with countries with lower incidence of malaria. They also found that a 10% reduction in the incidence of malaria resulted in a 0.3% rise in the annual economic growth rate. Bilharzia (Schistosomaiasis) is another disease in this category. The disease is caused by fluke worms found in water; once infected, a human being can suffer fever, intestinal disease, inflammation of the urinary system, and liver fibrosis (Gryseels, Polman, Clerinx, & Kestens, 2006). According to the World Health Organization (WHO), 200 million people, mostly in Africa, are affected every year (APPMG, 2009), leading to a loss of 1.7 million disability-adjusted life years (DALLYs) (Gryseels et al., 2006). One DALLY year represents a lost year of healthy life, and is used as an indicator of the quality of life of a population (UN-Water/WWAP, 2006). The burden of diseases, or DALLYs, associated with water affects developing countries, and especially African countries, disproportionately. For example, incidences and death caused by diarrhea to children under five years old in developing countries is 240 times higher than those of higher-income nations, while malaria in developing countries constitutes 85.7% of the annual global rate of malaria incidence and causes more than half a million deaths annually (UNDP, 2006 ; Kaler, 2008). Of the 257 million people affected by bilharzia globally, 213 million (83%) occur in Africa South of the Sahara (UNESCO-WWAP, 2003).

Water-washed diseases result from having insufficient water for washing and include diseases such as trachoma, which is responsible for blindness in many parts of the world. Blindness is a burden and contributes to social, economic, and developmental challenges. In India, blindness and poverty have been found to be highly correlated (Naidoo, 2007): Those with incomes of US$4.5 -11.3 per month had a 5-10% risk of being blind because of unsanitary conditions and poor medical attention.

A household survey conducted by the UNDP (2006) in developing countries clearly linked water and sanitation services to improved health and reduced child mortality (Table 1.2). Children who are frequently exposed to water-related diseases are also affected in school. The diseases reduce their cognitive potential, leading to attention deficits, absenteeism, and eventually dropout, which worsens their overall economic prospects (UNDP, 2006). Studies in Kenya have shown that provision of clean water and handwashing facilities reduced episodes of cholera leading to a reduction of absenteesm by 35% (O'Reilly, et al., 2008).

Table 1.2: Reduction in child mortality associated with access to adequate water and sanitation services (between 2000 and 2005).

Country	Reduction in child mortality (%)
Uganda	23
Ghana	70
Vietnam	40
Egypt	57
Peru	59

Source: (UNDP, 2006)

1.2.3 Water and Energy

Access to energy is necessary for economic, social, and political development (Kauffmann, 2005). Energy contributes to economic development through mechanization, modernization of communication technologies, and private sector investments. Water and energy are intricately linked. On the one hand, a significant amount of water is needed to produce energy. On the other hand, energy is needed to source, produce, and transport water. Energy is needed to transfer water to water-scarce regions, to desalinate water, and to pump water out of deep underground sources. Many forms of energy require water for different purposes. Coal-based energy, geothermal energy, and nuclear power all require large quantities of water for processing and cooling, while hydro-electric power requires water to turn tubines to generate electricity. Availability of water is therefore a critical factor in determining energy potential in a region. When energy is limited or too expensive, development is curtailed and employment opportunities are constrained.

Hydroelectric power, generated by water flowing or falling through electric turbines, has much potential in developing countries, including those in Africa. In Africa, however, only 84,958 Gigawatts/hour (GWh) of the 471,062 GWh potential, or 18%, has been developed (HYDROPOWER, 2006). This is due to many factors including lack of infrastructure to transmit electricity, the difficulties faced by African countries in attracting investments due to poor credit ratings, public and private sector corruption, disputes over water rights, and environmental issues. The development of the 200 Megawatts (MW) Bujagali hydro-project in Uganda was halted in 2003 due to an allegation that it would destroy Uganda's scenic landscape and therefore negatively affect the tourist industry. The second phase of the Sondu Miriu hydro-project in Kenya was stopped because of inadequate funding and environmental concerns. In Mali, the development of the 200 MW Manatali Dam was held up for 13 years because of disputes over water rights (HYDROPOWER, 2006). Despite these challenges, many countries in Africa still rely heavily or entirely on this form of electricity for their industrial energy (e.g., Congo DR, 100%; Tanzania, 91%; Uganda, 100%; Ethiopia, 99%; Burundi, 100%; Malawi, 98%; Kenya, 74 %). These countries are therefore prone, or potentially prone, to energy deficits due to water scarcity. Frequent droughts in Africa not only reduce the supply of water to major cities but can also reduce the supply of electricty by up to 70% (Economist, 2009) . In Kenya, Tanzania, and Ethiopia, the 2009 drought reduced river flows and substantially lowered the generating potentials of hydro-electric dams. The Kenya Power and Electric Company shut down Masinga dam after water levels dropped from 1957 cm in 2006 to 1036 cm in August 2009 (Ombok, 2009). In Ethiopia, frequent blackouts in Addis Ababa were attributed to low levels of water in major hydro-electric plants, including the delay in operating the new Tekeze hydro-project meant to contribute 300 MW of the current 1170 MW generated in the country (Economist, 2009). In Tanzania, power was rationed between 8 am and 5 pm for several months in 2006 due to a drought that reduced water levels in Mtera Dam (the main hydro electric dam in the country) by up to 59 cm (BBC, 2006). Drought in Ghana (2005-2006) affected gold and aluminum production and also caused blackouts in Togo and Benin which buy electricty from Ghana (Wines, 2007).

Among the many factors that affect education, the availability of energy and water has been shown to play a significant role. For example, the availability of electricity frees girls and women from spending much of their time on survival duties (e.g. collection of firewood and water), allowing them to direct their energies to gainful employment and schooling. Indeed, scholars and development experts generally agree that the burden of collecting fuel and water has contributed to a large gender gap in school attendance in many developing countries (Colclough, Rose, & Tembon, 2000). The evidence for such a connection appears persuasive. In Tanzania, for example, school attendance was 12% higher in schools situated within 15 minutes of a water source than those an hour away (UNDP, 2006). In Mozambique, Senegal, and Uganda, women and girls spend between 15-17 hours per week collecting firewood. This represents an opportunity cost for education, income generation, and community development (Colclough, Rose, & Tembon, 2000; UNDP, 2006).

Electricity also plays an important role in the health status of people. About 3 billion people globally rely on biomass and coal for heating and cooking. Of these, 800 million rely on agricultural residues and animal dung as a source of energy due to severe wood shortages (Colclough, Rose, & Tembon, 2000; Kammen & Kirubi, 2008; WHO, 2008). These sources of energy produce carbon monoxide and other pollutants, which can cause respiratory infections, lung diseases, and eye problems (UN-Water/WWAP, 2006). The pollutants are also linked to pregnancy-related problems such as stillbirth (UNDP, 2006). Studies from India, Guatemala, and Zimbabwe have found that immune systems and physical weight development for young children are compromised due to indoor air pollution resulting from biomass burning (Vinod, 2004;UNDP, 2006).

1.2.4 Water and Ecosystems

Water plays a major role in mediating ecosystem processes necessary for survival, transport, waste disposal, and industrial processes (UN-Water/WWAP, 2006). Ten percent of poor people in developing countries depend directly on natural ecosystems (UNESCO, 2009). These include pastoralists moving from one water source to another, fishermen, and those who rely directly on forest ecosystems for food. Aquatic ecosystems in particular also provide a range of other economic-environmental benefits that include flood control, ground water recharge, shoreline stabilization and protection, water purification, preservation of bio-diversity, recreation, and tourism.

About one million of Africa's urban inhabitants rely on natural wetlands for waste water retention and purification services worth millions of dollars (UNEP, 2007). Wetlands can remove metal pollutants, and retain sediments and nitrogen from runoff and in the process purify water. In Uganda, for example, the Nakivubo swamp provides wastewater treatment and purification services worth $363 million to the citizens of Kampala (Worldwatch Institute, 2007), as well as providing other goods and services, including farming, papyrus harvesting, fishing, tourism, and brick making (Bikangaga, Picchi, Focardi, & Rossi, 2007). The Zambezi basin in Zambia, Zimbabwe, Angola, and Mozambique is valued at $45 million as well as $16 million worth of ground water recharge (Turpie, et al, 1999). Clearly, then, it is critical to manage these ecosystems in a sustainable manner to maintain all their vital functions. Episodic or sustained water scarcity and water degradation in many basins has, however, threatened the health of some of these ecosystems, limiting their economic benefits. For example, in Asia, the desiccation of the Aral Sea has left the lake unable to maintain healthy aquatic systems. Due to diversion of rivers draining into the Aral Sea, the lake has lost half of its surface area and three-quarters of its volume, leading to the extinction of 24 native species and the loss of 6,000 fish-related jobs (Macklin, 1978; Postel, 2000). Similar scenarios have been repeated to varying degrees in Lake Chad in Africa and Lake Cahapala in Mexico, as well as in several river systems including the Colorado (USA), the Nile (eastern Africa), and China's Yellow River.

1.3 The Research Problem

Given the foregoing discussion of the importance of water, particularly with regard to developing nations, this dissertation examines historical, as well as current water reforms in Kenya, with a view of evaluating the degree to which they have facilitated or hindered water access and MDGs targets. Kenya is among the most water-stressed countries in Africa (Table 1.3) (Falkenmark, 1990; Gleick, 1993). It is also a resource-dependent economy. Forty percent of Gross Domestic Product (GDP) is generated in resource-based sectors such as agriculture, forestry, fishing, tourism, and mining. Collectively, these sectors employ over 65% of the labor force (KIPRRA, 2009). The combination of water scarcity, (defined in greater detail in section 2.2) and a resource-dependent economy presents serious challenges for the government of Kenya in its quest for economic development.

On a national scale, Kenya has an estimated renewable fresh water supply of 647m^3 per capita per year, which is far below the 1700 m^3 per capita per year necessary for a productive and healthy nation, and below the 1000 m^3 per capita per year limit below which a country is considered to be "water scarce" (Falkenmark, 1990). Only about 50% of Kenya's population has access to at least 20 liters per person per day obtainable within one kilometer of residence (UNESCO-WWAP, 2003). Thus, access to water in Kenya is below the global average of 87% (96% in urban and 78% in urban and rural areas, respectively), as well as the sub-Saharan Africa average of 63% (81% and 46% in urban and rural areas, respectively) (UNDP, 2009). In the related area of sanitation, the coverage is equally bleak at 52.5% (65% and 40% in urban and rural areas, respectively) compared to a global average of 62% (79% and 45% in urban and rural areas, respectively) (Gulyani, Talukdar, & Kariuki, 2005; UNDP, 2009). The problem is confounded by population which increased rapidly from 11 million people in 1970 to 38.7 million in 2010, and the per capita water availability which dropped during the same period from 1800m^3 to its current value of 647m^3 (Figure 1.1). These statistics show that a large proportion of people in Kenya are either not served or are underserved with water and sanitation services.

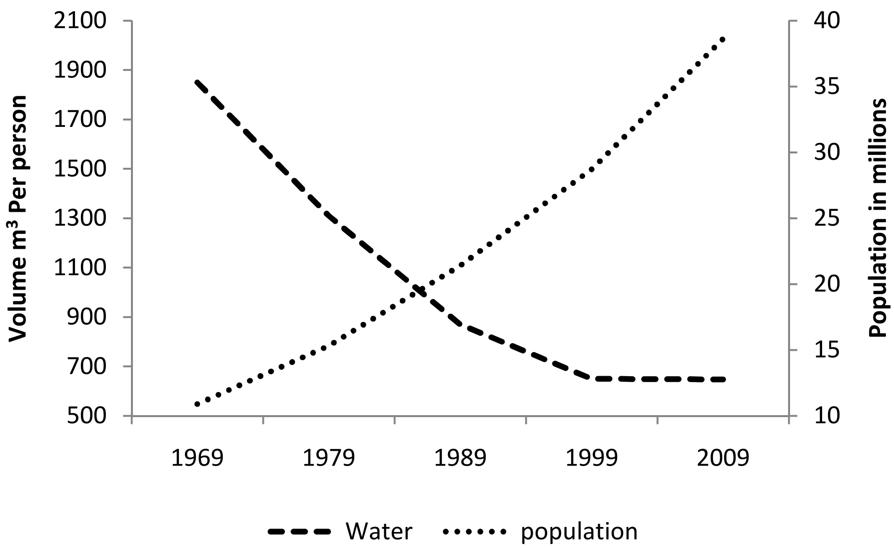


Figure 1.1: Population growth and water availability in Kenya 1969-present.

In response to this problem, Kenya has tried different strategies with different water access targets over the past few decades. The government enacted the 1974 *National Water Master Plan* with the aim of ensuring availability of portable water within a reasonable distance (2 kilometers of residence) to all people by 2000 (GoK, 1992). Kenya also joined global initiatives that defined time-bound targets for water and sanitation coverage to be achieved by specified dates. These initiatives included: (1) The International Hydrological Decade (IHD), between 1965 and 1974; (2) The International Drinking Water Supply and Sanitation Decade (IDWSSD), between 1981 and 1990; and (3) The International Decade for Action, Water for Life (IDAWL), between 2005 and 2015.

Table 1.3 Per capita water availability in 1990 and 2025 for selected African countries countries

Country	Per capita water availability 1990 (m^3 per person Per year)	Projected per capita water availability 2025 (m^3 per person Per year)
Algeria	750	380
Burundi	660	280
Djibouti	750	790
Egypt	1070	620
Ethiopia	2360	980
Kenya	590	190
Lesotho	2220	930
Libya	160	60
Morocco	1200	680
Nigeria	2660	1000
Rwanda	880	350
Somalia	1510	610
South Africa	1420	790
Tanzania	2780	900
Tunisia	530	330

Source: Gleick 1993

Despite the many decades of concerted efforts of water reforms driven by global and local initiatives, evidence suggests that water access and sanitation coverage in Kenya are still dismal. While the 1974 plan called for all Kenyans to have adequate water access, evidence suggest that only about half had this access three decades later. If only about 50% of the population have access to water, then clearly the water policies and reform efforts adopted to date have not achieved their objectives. The question is: Why? Discovering the answer to this question might allow Kenya to avoid the pitfalls of the past and therefore increase its chances for success as it implements new reforms under the 2002 water reform act. This new law basically decentralized the management of water services in the country, by allowing more stakeholder participation in the management process and transferring the role of water provision from the government to Water Service Boards (WSB) and Water Service Providers (WSPs). Policy analysts attribute poor performance in the past to over-centralized management systems riddled with inefficiencies and low productivity, poor policies, environmental problems, corruption, and lack of financial resources (Estache & Kouassi, 2002; Magoka, et. al., 2006;Mumma, 2007; Owuor & Foeken, 2009). However, no comprehensive study has been made that evaluates and analyze water reforms in Kenya in the light of the past and present water access goals and targets. This dissertation seeks to make a contribution by exploring the process through which Kenyan water policies have evolved from the colonial period through 2010, and analyze the effects of such policies on access to water. In particular, the dissertation analyzes how the water sector reforms under a new law (*Water Act of 2002)* are contributing to or hindering the attainment of MDGs related to water.

1.3.1 Research Objectives

Given the foregoing background, this research therefore reviews the evolution of water reforms in Kenya in order to untangle the factors responsible for the success or failure of these reforms. The results of the analysis should enable barriers to the improvement of access to water to be identified and ways forward to be elucidated. In addition, the findings should allow best practices to be identified that may be valuable to other countries or regions with similar socio-political situations (primarily the African nations) or pitfalls that should be avoided in formulating or implementing regional-scale water reform policies. Therefore, the objectives of the dissertation are:

1. To investigate how global water targets and policies have influenced water institutional reforms (at a national scale) in Kenya from the colonial period to the year 2000, as well as the outcomes of those reforms.
2. To examine the institutional reforms that have taken place since the declaration of MDGs in the year 2000, in which the country seeks to reduce by 50% the population without access to safe water and sanitation coverage by 2015, and to assess how these reforms are facilitating or hindering the achievement of the MDG for water.
3. To quantitatively analyze the productivity and efficiencies of Water Service Providers (WSPs) in Kenya, and then to evaluate the extent to which these WSPs are meeting the stipulated minimum level benchmarks recommended by the Water Services Regulatory Boards (WASREBs) and making progress towards meeting the MDGs for water.

1.4 Introduction to Approach and Methodology

This dissertation adopts a case study approach employing mixed methods. Global policies and principles of water governance adopted from the international community are based on generalized concepts designed to be globally applicable (Yin, 1994; GWP, 2003;Hay, 2000). Hence, they are broad-based and need to be filled with details based on the unique historical and environmental contexts of specific regions and countries. Molinga et. al. (2006), for example, notes that management concepts such as Integrated Water Resources Management (IWRM) can be seen as boundary concepts that allow different players to attach different meanings and management designs to them. A case study approach is therefore appropriate because it provides an avenue to move from general global water policies and principles to specific processes at the local level, where it is critical to study a phenomenon within its real life context (Yin, 1994). The approach therefore focuses the study on the unique socio-economic and political conditions in Kenya that hinder or facilitate the implementation of water reforms and the MDGs, as well as on the appropriateness of the theoretical basis of the suggested policies to Kenya's situation. Such a context is important because the meaning, significance, and implementation of water reform policies at local scales are driven by diverse stakeholder involvement in a constant state of negotiation and interaction (Cervoni, 2007).

Within the case study approach, the study utilizes mixed methods, which combine quantitative and qualitative techniques, methods, approaches, concepts, into a single study (Johnson & Onwuegbuzie, 2004). The method is effective because of its philosophical attempt to bring together the strengths of qualitative and quantitative methods. The mixed methods approach is outlined further in Section 3.1. Objectives one and two are addressed through qualitative means, including an archival and literature review and a questionnaire survey. These objectives are mainly descriptive in nature and seek to evaluate water's institutional evolution in Kenya and the impact of global policies on the processes surrounding water reform and access. Primary survey data were collected through questionnaires administered either through face-to-face interviews or distributed via e-mail to a purposively selected (Patton, 1990) professional community, including workers in the water sector and members of institutions of higher learning. Further details regarding the archival and survey methods used are presented in Sections 3.3 and 3.4, respectively.

Inefficiencies in WSPs have been identified as a major factor explaining the slow progress in improving water access and therefore slowing the movement towards achieving the MDGs in African countries (Estache & Kouassi, 2002; Kirkpatrick, Parker, & Zhang, 2006). To achieve Objective three, the study uses Data Envelopment Analysis (DEA) to quantitatively analyze and compare the efficiencies of WSPs. DEA is a non-parametric method that applies linear programming to input and output data to estimate a production frontier. The performance of a firm, measured in terms of efficiency and productivity, is represented by the distance of the firm from this production frontier (Anwandter & Ozuna, 2002). The results of this analysis are then used to evaluate the extent to which these WSP are meeting the stipulated minimum level benchmarks recommended by WASREB (WASREB, 2009). The benchmarks are incremental steps towards achieving the MDG for safe, accessible, and affordable water services. A full account of DEA is provided in Section 3.5.

1.5 Structure of the Dissertation

This dissertation is divided into six chapters (Figure 1.2). Chapter One has provided a brief introduction, including presentation of the background, the rationale for the research, the purpose and objectives of the study, and the approach taken. Chapter Two reviews the current global discourse on water scarcity as well as how this discourse has shaped and continues to shape water policies and development in many countries. The chapter identifies emerging trends and issues in the global water discourse. In particular, Chapter Two: - (a) provides a review of the major types of water scarcity (physical water scarcity and institutional water scarcity) as well as the policy implications associated with each type; (b) reviews the key water governance principles (for example IWRM) and resolutions articulated in international forums, and (c) reviews the current global progress towards achieving the MDG related to water provision and sanitation services.

Chapter Three describes the study area (Kenya) and details the approach taken in the research and the methods used. The pertinent characteristics of the case study country are presented, and the merits of the case study approach are discussed. A mixed methods approach is used in the research, comprising both qualitative and quantitative elements, and the features and value of such an approach are explored in this chapter. The main methods used are archival research, questionnaire survey, and Data Envelopment Analysis. These methods are presented in terms of what was done and why, and are discussed with regard to how they contribute to answering the research problem and objectives.

Chapter Four is based on archival and questionnaire survey research, and provides a historical overview of water resources in Kenya as well as the institutional arrangements of water management since the colonial period. The chapter sets a context regarding what the country has tried to do and the outcomes of those experiments. With such a background, the chapter next examines the institutional reforms that have taken place since the declaration of MDGs in the year 2000. This review focuses on three main institutional elements: National water policies, the legal framework, and management arrangements.

Chapter Five comprises a review of policy instruments related to the provision of water supply between the years 2000 and 2010. The chapter focuses specifically on the performance analysis (using Data Envelopment Analysis) of different Water Service Providers (WSP). The analysis is based on the following key indicators: water coverage; unaccounted for water (UFW); collection efficiency; and hours of water supply.

Chapter Six synthesizes the results and discusses the main findings of the study. A summary is provided of the status of water reforms at a national and basin scale. The chapter includes an evaluation of the extent to which these reforms have contributed to the progress towards the achievement of the MDGs related to water. In addition, the implications of the study are highlighted, and recommendations are given for further actions regarding water reform policy and management.

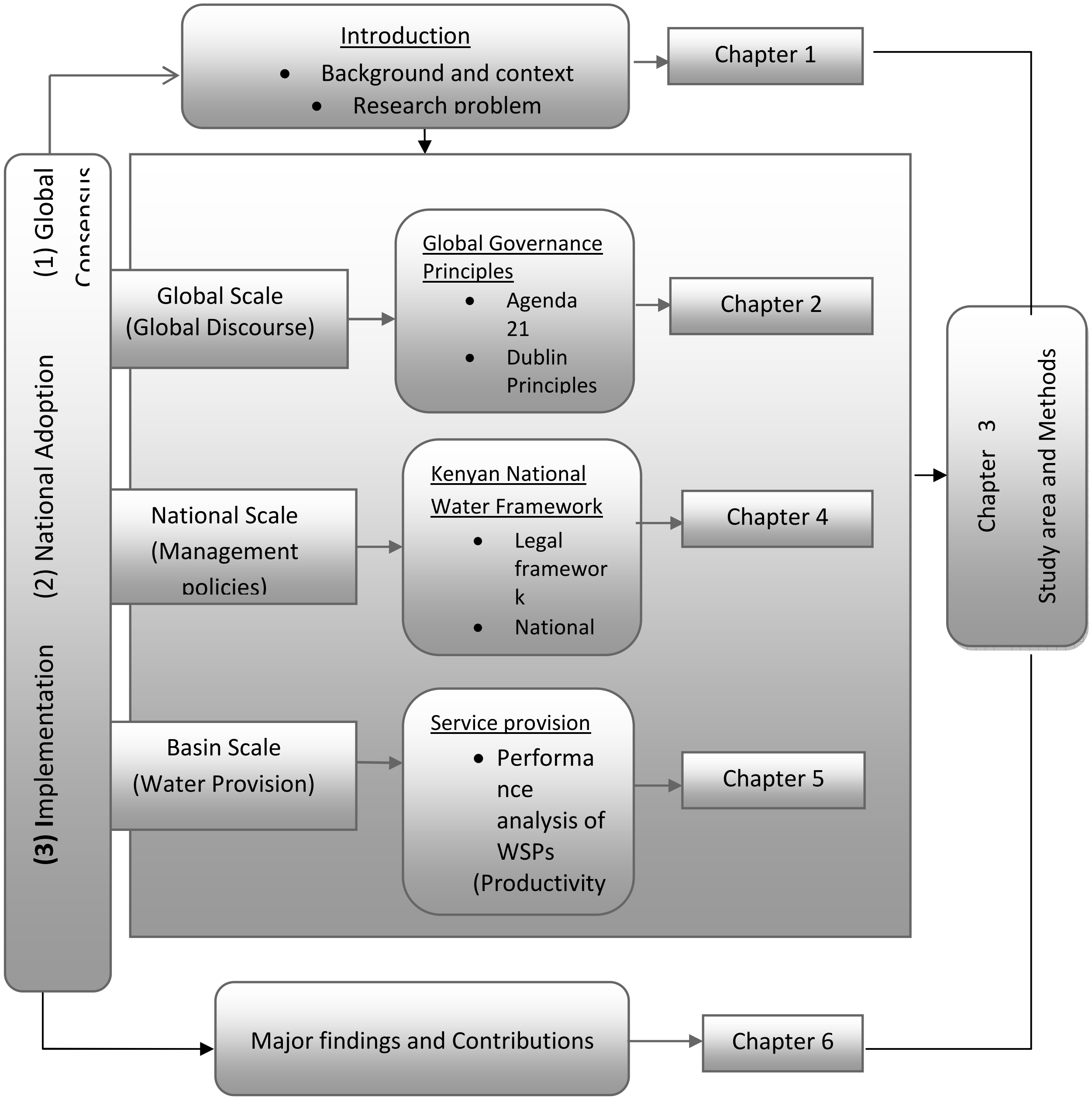


Figure 1.2: Diagrammatic representation of the research structure of the dissertation.

Chapter Two: Global Water Governance

2.1 Introduction

The global water discourse over the last four decades has centered on, among other things, the role of water in development, as well as how water scarcity threatens this goal (Cullis & O'Regan 2004; Hussain & Hanjra 2004; Sullivan & Meigh, 2003; Rijsbeman, 2003). Water scarcity and stress, as discussed in Section 2.2, are not only a function of physical water availability, but are also manifestations of institutional problems that fail to address social, economic, political, and cultural aspects of water resources (UNDP, 2006).

2.2 Water scarcity

Water scarcity is a relative concept, frequently defined on a continuum that stretches from water abundance at one extreme to water scarcity at the other. In between these two limits, several intermediate conditions have been recognized, including water stress (Anand, 2007). In general, scholars tend to discuss these concepts at the level of the nation state and very rarely in terms of regions or smaller geopolitical units. On one hand such an approach is likely driven by the relative availability of data at this scale. However, on the other hand, it also likely reflects the belief that water provision is, or should be, the responsibility of the nation state (Shiva, 2000). A review of the literature shows that water scarcity occurs because of absolute water shortage (i.e., a physical water scarcity) and/or Institutional failures, as discussed in the following sections.

2.2.1 Physical water Scarcity

Physical water scarcity is defined as a situation where demographically induced demand for water exceeds the current level of water availability (Rijsberman, 2006). Scarcity in this case is measured in two ways: per capita water availability, or use-to-resource ratio. Falkenmark (1989) developed the first water stress indicator as a ratio of the physical availability of water (at a country level) to population (Table 2.1). The index was developed after analyzing the gross amount of renewable water resources (in flow units, where 1 flow unit =1000m^3) available to a country from all sources while conducting research in Africa and the Middle East (Falkenmark, 1989). A basic assumption of her study was that water resources are relatively finite but populations change. Thus, as population increases, per capita availability must decrease. Falkenmark was well aware that water availability could be increased through technical innovations. However, she argued that, for poor developing countries (and particularly those in Africa), an inability to take advantage of technical solutions means that water resources are practically finite.

According to Falkenmark's (1989) index, a country is considered water sufficient if its total annual renewable water resources per capita exceed 1700 m^3. This amount represents the minimum required for domestic requirements and agriculture in resource-based economies such as many of those in Africa and the Middle East. A country so classified is in no danger of running short of water in the foreseeable future, given prevailing conditions. A country is classified as water-stressed if its per capita water availability is between 1000 and 1700 m^3/per year. This designation implies that the country is at risk of becoming water-scarce at some point in the future if water quantity becomes diminished (due to, for example, population increase and climatic variability), and/or the quality of water resources becomes degraded due to pollution. A country is considered to be water-scarce if water availability is below 1000m^3/capita/year, a level that will pose constraints to economic development and health. Finally, water availability below 500m^3/capita/year poses acute constraints on life and survival. Many organizations, including UN agencies such as the FAO, have adopted Falkenmark's index either in its original form (Table 2.1) or with some modification (Table 2.2). The Population Action International (PAI), in both 1993 and in 1997, used the index to rank countries of the world in order of scarcity. The study revealed that 166 million people in 18 countries suffered from water scarcity at the end of the Decade of International Drinking Water and Sanitation in 1990, and 270 million people in 11 countries were under water stress (Gleick P , 1993).

Table 2.1: Falkenmark's (1989) water scarcity levels.

Per capita water availability (m^3/c/y)	Stress Level
>1700	No stress
1000-1700	Water stress
500-1000	Water scarce

While Falkenmark's (1989) indicator is widely accepted because of its simplicity, it has a number of shortcomings. The index assumes that water availability is constant, on which basis it has often been criticized as being neo-Malthusian in its logic and view of water. For example, Anand (2007) somewhat dismissively claimed that the concept is premised on the following linear logic: Population continues to grow while the amount of water available in a given country is fixed by natural factors; this water is essential for food security; as population increases, per capita water availability decreases and countries will eventually face water scarcity; since policy cannot control natural factors, policy must control population and water use. Other critics have further charged that this neo-Malthusian view of water scarcity assumes that food security critically depends on food grown within the country, which then depends on available water resources that do not change over time. Thus, the concept appears to subscribe to environmental determinism and ignores the power of technological, trade-related, social, and cultural capabilities (Ohsslon, 1999; Allan, 2005).

Another shortfall of the index is that it takes into consideration all renewable water resources including some that may not be controlled or utilized (e.g., floods) (Molle & Mollinga, 2003). Indeed, for technical and other reasons, no country will ever be able to utilize all of its renewable water resources. To remedy this shortfall, some researchers (e.g. Raskin, et al., 1997, Alcomo et al., 2000) have recommended the use of water withdrawals (use-to-resource ratio) instead of renewable water resources. Using a global hydrological model, Alcomo et al. (2000) developed the Water Resource Vulnerability Index (WRVI) to model long-term global water resources (1995-2025) based on different water availability and usage scenarios. The authors used what they term the “critical ratio” (resource availability to usage ratio) to define water stress and scarcity. Based on sensitivity analysis performed in different basins of the world using different thresholds, a country is classified as water stressed if its withdrawals are between 20-40% and as water scarce if withdrawals exceed 40% of available renewable water resources. Working independently, Vörösmarty, et al. (2000) came to more or less the same critical use thresholds. The WRVI shows that 25% of Earth’s terrestrial surface, containing more than 2.1 billion people, is under severe water stress, while the study by the International Water Management Institute (IWMI) shows that by the year 2025, approximately 1.4 billion people, mainly in Africa, will suffer from water scarcity problems (Secler, et al., 1998).

Falkenmark’s indicator is also imperfect because it does not take into account ecosystem water use; Furthermore, the index does not distinguish between water withdrawn and water effectively used or returned back to the system, including water recycling. The index also disregards the question of virtual water as an option, although in defense of the index, at the time of its derivation, the concept of virtual water was in its infancy.

Table 2.2: FAO's thresholds of water scarcity

Threshold (Population per flow unit)	Nature of the problem	Conversion of threshold to cubic meters per capita
Below 600 persons per million cubic meters	Not serious. Water quality and flows during dry seasons may occur	1667
600 to 1000 persons per million cubic meters	Water stress stage: Increased chances of recurrent quantitative and qualitative problems	1000 -1667
1000-2000 persons per million cubic meters	Scarcity stage: Quantity and quality problems common and affect human and economic development	500-1000
2000 persons per million cubic meters	Water Barrier: Maximum population pressure that can be handled in the present state of technology and management capabilities	Below 500

(Food and Agriculture Organization (FAO), 1994)

As noted, water scarcity is a multi-dimensional phenomenon that involves both the physical availability of water including its quality status, as well as socio-cultural, economic, political, and structural dimensions. These other dimensions are equally as important as the physical availability of water but are not represented in the physical water scarcity index. Consequently, some authors (Ohlsson, 1999; Sullivan, 2000) have modified the Falkenmark index to include a weighted sum of physical, social, economic, and political variables. Ohlsson (1999), for example, divided Falkenmark's index by the Human Development Index (HDI) to produce the Social Water Scarcity Index (SWSI) to indicate society's ability to cope with water scarcity. The HDI (http://hdr.undp.org/en/statistics/) is a composite index developed by the United Nations Development Program (UNDP) to measure the standard of living within a country using the three basic variables of health, education, and income. Ohlsson reasoned that countries with a high HDI are best equipped to adapt to water scarcity problems. Adaptive capacity, defined as the socio-economic ability of people or a region to deal with the effects of scarce water (Ohsslon, 1999), is a function of the institutional arrangements in charge of water management and development. Based on this index, countries such as Iran and Cyprus, which were formerly classified as water-stressed by Falkenmark's index, were reclassified (in 1999) as having relatively sufficient water and countries such as Oman and United Arab Emirates moved from water-scarce to water-stressed due to their high social adaptive capacity. In contrast, countries such as Rwanda, Burundi, and Ethiopia were recast from water stressed to water scarce due to their poor adaptive capacity.

It is, however hard to determine whether incorporating HDI factors in the calculation of SWSI allows the ability of a society to deal with scarcity to be determined. The HDI includes life expectancy, educational attainment, and GDP, and it is unclear whether these broad measures are intimately related to a society's ability to manage water. Another problem with the SWSI is that there is an implicit assumption that the relationship between the numerator (Falkenmark's index) and denominator (the HDI) is a simple linear function over the whole range of the values of numerator and denominator, i.e., doubling the value of the water resources measurement anywhere on the scale is the same as halving the value of the social resources measurement. This is unlikely to be the case, given the distributions of values of Falkenmark's index and the HDI for different countries.

Sullivan (2002) developed the *Water Poverty Index (WPI)* as a weighted average (*w*) of five variables: Resources (R), Access (A), Capacity (C), Use (U), and Environment (E), as defined in Table 2.3. Mathematically, these variables are aggregated using the following equation:

$$\mathrm{WPI} = \frac{w_r R + w_a A + w_c C + w_u U + w_e E}{w_r + w_a + w_c + w_u + w_e} \qquad 2.1$$

The level of water scarcity, based on the equation, will fall between 0 (the worst situation) to 100 (the best). Unlike Falkenmark (1989) and Alcamo et al. (2000), however, Sullivan does not provide a threshold at which water will be considered stressed or scarce. While the index is comprehensive, it is hard to implement because of its complexity, value judgments, and cultural biases owing to arbitrary weights assigned to different measures (Rijsberman, 2003; Molle & Mollinga, 2003).

Table 2.3: Water Poverty Indicators.

WPI Component	Data Used
Resources	• internal Freshwater Flows • external Inflows • population
Access	• % population with access to clean water • % population with access to sanitation • % population with access to irrigation adjusted by per capita water resources
Capacity	• ppp per capita income • under-five mortality rates • education enrolment rates • Gini coefficients of income distribution
Use	• domestic water use in litres per day • share of water use by industry and agriculture adjusted by the sector's share of GDP
Environment	indices of: • water quality • water stress (pollution) • environmental regulation and management • informational capacity • biodiversity based on threatened species

2.2.2 Institutional Scarcities

Water scarcity can be a manifestation of institutional inefficiencies, such as economic institutional failures, management failures, as well as political and social failures. Due to such failures, water scarcities may occur even in the presence of physical water abundance. In such a situation, a country requires policies that will allow the development and maintenance of effective institutional arrangements to harness and distribute water to needy regions.

Economic scarcity manifests itself when people or a country lack resources to make water available to them (Anand, 2007), or because economic instruments disenfranchise the poor, especially those living in rural or urban slum areas. In many developed countries, water has been treated as an economic good for many decades (Rogersa, Silvab, & Bhatiac, 2002). The concept of water as an economic good implies that water is allocated to different users based on its value. The value of water is determined by demand (its utility to humans and their willingness to pay) and supply (the cost of providing the water). In much of the developing world, concerted efforts to view water as an economic good did not begin until the Dublin Conference of 1992, in which participants called for water to be subjected to market forces.

However, the concept of water as an economic good is very controversial, and its implementation in some regions of the world has led to pricing of water in a way that has damaged the interests of the poor and caused further shortages (Savenije & van der Zaag, 2002). For example, between 1997 and 2000 in South Africa, there was an increase in both water scarcity and waterborne diseases after the country implemented "full cost recovery principles" (Shiva, 2000). Ten million South Africans had their water supply cut off because of their inability to pay their water bills (Johnston, 2003). In Bolivia, the privatization of Cochabamba's municipal water supply resulted in a price hike that led to massive water shortages and strikes (Shiva, 2000; Johnston 2003). The drought of 1995 that led to water shortages in Yorkshire, Britain, has been partly attributed to the regulatory framework and the economics of private companies that favored shareholders over consumers (Bakker 2000). Scarcity in these examples is economic in nature because it reflects people's inability to pay for water. Economic water scarcity also reflects governments' inability to provide the necessary financial resources for water sector development. Between 1.4 billion and 1.6 billion people live in countries that lack sufficient resources to build the infrastructure required to tap water and deliver it their citizens (UNDP, 2008). These countries will require massive investments in the water sector to alleviate these problems.

In contrast to economic water scarcity, political and managerial scarcity occurs when people lack water because of political subordination or poor management (Molle & Molinga, 2003). Water scarcity is not only a function of supply and demand but also an aspect of social relations and control over land and water resources (Johnson, 2003). For example, the settlement of European farmers in Zimbabwe's high veldt and Kenya Highlands during the colonial years (between 1890 and the 1960s) resulted in the relocation of African peasants to water-scarce native reserve lands, to ensure sufficient land and steady access of water to white settlers within the acquired areas (Bell &

Roberts, 1991; Southgate & Hulme, 2000). Derman & Ferguson (2003), in their study of water reform in Zimbabwe, note that during the colonial period the natives were disenfranchised through the Priority Date Water Allocation System (PDS), which blocked African farmers from competing with white farmers over water. In Kenya, through the *Crown Ordinance*, all water was placed under the authority of the Queen of England, denying local people the express right to water, except that needed for domestic purposes (Nyanchaga & Ombogi, 2007). Thus undemocratic control of water can also create scarcity.

Another form of scarcity is a combination of poorly implemented economic and political policies. The neoliberal policies introduced to the Chilean water sector in the 1980s, for example, shifted the power over water resources in favor of large irrigation farmers (Budds, 2004), whereby access to water was highly politicized and controlled through intricate links of economic and political power. Commoditization of water through privatization in Bolivia (Shiva, 2000), California (Johnston 2003), and South Africa (Derman & Ferguson, 2003) in all cases shifted the controlling power from local citizens to external bodies whose main goal was to maximize profits within a very short time, with very little interest of extending water supply to the poor.

Somewhat similar to the above classifications (Falkenmark, 1989; Sulivan 2000; Alcom et. al 2000; Molle & Mollinga, 2003), Turton & Warner (2002) have developed a simple categorization scheme (Figure 2.1) in which the scarcity status of any resource is the result of the intersection of physical scarcity and institutional capability. The schema considers first-order resources to be any natural resource (e.g. water, minerals, and forests). The first-order resource (in this case water) can be abundant or scarce both spatially and temporally. Second-order resources refer to institutional arrangements in the water sector. A region with physical water scarcity may not experience as much water stress or scarcity if it has strong and efficient institutions (social, economic, and political) to deal with the otherwise debilitating effects of scarcities (such as food shortages). Turton & Warner (2002) define the following levels of water scarcity:

a) Structurally-Induced Relative Water Scarcity (SIRWS) – occurs in a region with relatively high amount of water (position 1) with a relatively low level of second order resource (position 4). Scarcity in this situation occurs as a result of weak institutions responsible for managing the resource.

b) Structurally-Induced Relative Water Abundance (SIRWA) – These regions are characterized by low level of water availability (position 3) with relatively high level of second order resource (Position 2). Water institutions in this case are very strong and able to mobilize socio-economic resources to provide water access in arid regions. Oil rich countries in the Middle East are examples of such countries.

c) Water Poverty (WP) - Combination of low level of water availability (Position 3) with relatively low level of second order resource (position 4). These regions experience extreme physical water scarcity and at the same time lack social and economic resources such as infrastructure and income.

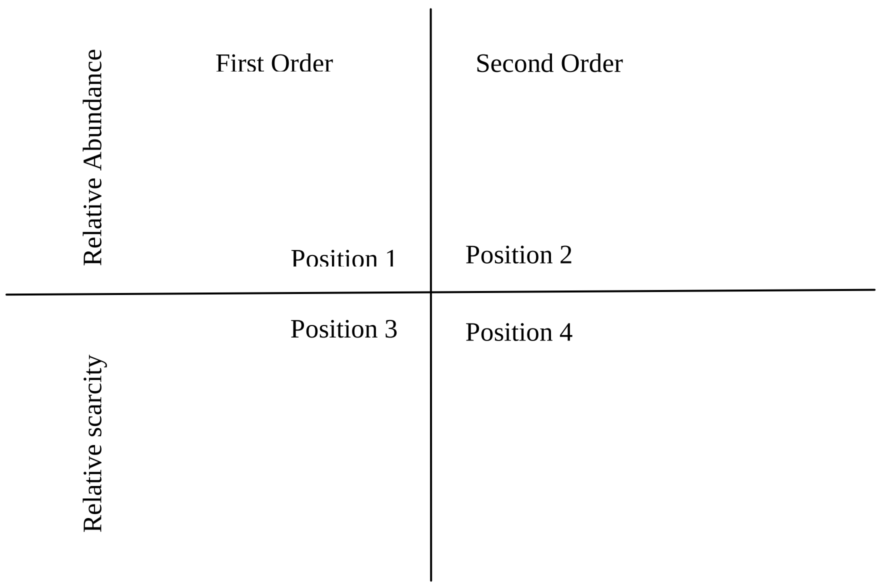


Figure 2.1: First and second Order Resources (Turton & Warner 2002).

From the review therefore, the concept of water scarcity is somewhat elusive and its causes and consequences can be manifested in the realms of the economy, environment, social structures, and politics. The next sections discuss the global efforts to combat the problem.

2.3 Global Water Initiatives (GWIs)

Given the centrality of water to human survival and welfare, global initiatives to promote or assure access to water have a long history, championed primarily by the

United Nations (UN). Table 2.5 summarizes the major conferences regarding water and their outcomes and initiatives. The table also indicates that Global Water Initiatives (GWIs) include institutional frameworks, organizations, special events, and campaigns that focus attention on water resource management. Some GWIs represent a set of targets to be achieved within a specific period of time, usually a decade (Varady,et al., 2008).

Many scholars agree that GWIs represent globalized agendas, where the UN and other international agencies shape the national and international water policy and management process (Varady, Meehan, & McGovern, 2008). The GWIs have therefore resulted in a governance framework where: (1) Policy processes have shifted from centralized management towards a decentralized management system based on global-level principles and governance mechanisms agreed upon in international conferences (Allan, 2005, Varady, Meehan, & McGovern, 2008); (2) Global water targets to reduce the proportion of people without access to safe drinking water and sanitation have been agreed upon; and (3) Countries have adopted these policies in an attempt to meet the targets (McGranahan, 2003, Swatuk, 2002). The following paragraphs review the past and present GWIs and evaluate the achievements and failures of these initiatives in extending water and sanitation coverage. These initiatives include: (1) The International Hydrological Decade (IHD) 1965-1974; (2) The International Drinking Water Supply and Sanitation Decade (IDWSSD) 1981-1990; and (3) The International Decade for Action, Water for Life (IDAWL) 2005-2015. The review of these efforts will reveal any historical analogues to current water problems and therefore shed light on current policy efforts.

Table 2.4 : Major international conferences concerning water and its management.

Date	Event	Outcomes
1977	UN conference on water –Mar del Plata	**<u>Mar del Plata action Plan</u>** • Assessment of water resources, water use and efficiency • International Drinking Water and Sanitation Decade (1981-1990)
1992	International conference on water and the environment - Dublin	**<u>Dublin Principles</u>** • Fresh water is a finite and valuable resource, essential to sustain life, development and the environment • Water development and management should be based on a participatory approach, involving users, planners, and policy makers at all levels. • Women play a central part in the provision, management and safeguarding of water • Water has an economic value in all its competing uses and should be recognized as an economic good.
1992	UN Conference on environment and development (UNCED-Earth Summit), Rio de Janeiro	**<u>Agenda 21</u>** • Full Public Participation • Multi-Sectoral approach to water management • Sustainable water use
1997	First World Water Forum-Marrakech	**<u>Marrakech Declaration</u>** • Water and sanitation as a basic need • Mechanisms for effective management of shared water • Encourage efficient use of water
1998	International Conference on Water and Sustainable Development	**<u>Paris Declaration on Water and Sustainable development</u>** • Improve coordination between UN agencies and other organizations • To encourage political commitment and broad based public support to ensure sustainable management of water resources
2000	Second World Water Forum-The Hague	**<u>World Water Vision: Making Water Everybody's Business</u>** • Encourage stakeholder participation • Move to full-cost pricing of water services • Increase cooperation in international basins • Increase investments in water investments

2000	Millennium Summit-New York	**UN Millennium Declaration** • Halve by the year 2015, the proportion of people without access to safe and affordable water.
2001	International Conference on Fresh water - Bonn	**Bonn Principles** • The first key is to meet the water security needs of the poor • Decentralization is the key: The local level is where national policy meets community needs • The key to better water outreach is new partnerships • IWRM is needed to bring all water users to the information-sharing and decision-making tables • The essential keys are stronger and better performing governance arrangement
2002	World Summit on Sustainable Development Rio+10 - Johannesburg	**Johannesburg Declaration on Sustainable Development** • Poverty Eradication • Develop IWRM and Water use efficiency plans by 2005 • Employ full range of policy instruments including regulation, monitoring, market and information based tools
2009	Fifth World water forum-Istanbul	**Ministerial Declaration** • Intensify efforts to achieve MDGs • Improve IWRM at the river-basin scale • Demand side focused management • Sustainable development • Improve water governance at national level

2.3.1 International Hydrological Decade (IHD) 1965-1974.

At the onset of this decade, developed countries had overused and misused their water to the extent that further development of the resource would pose serious socio-economic and political problems (Walton, 1966). For example, the exploitation of water resources in arid regions in western USA (Gleick, 1993) had put serious strain on water resources in those regions. Developing countries, in contrast, lacked sufficient technical capacity and personnel to develop their water resources. Two-thirds of developing countries lacked enough data for water management and development planning due to scant measurements of river flows (Walton, 1966). These problems were further exacerbated by population increase, increased industrial and agricultural development, and contamination of rivers and ground water (UNESCO, 1963).

Due to these concerns, the 1964 general conference of the United Nations Educational, Scientific, and Cultural organization (UNESCO) through resolutions 2.221, 2.222 and 2.225 adopted recommendations to designate the years 1965-1974 as the IHD, with the goal of strengthening the connections between scientific research, application, and education in the realm of water (UNESCO, 1974). The goals were to strengthen global scientific knowledge for water management and planning, encourage education and training in hydrology, and foster collaboration between developed and developing countries in the realm of hydrology. The need for such a global program was justified based on the global nature of the hydrological cycle, and on the scarcity of hydrologist and water experts at that time (UNESCO, 1963). The goals of the decade would be achieved through five key objectives geared towards understanding the hydrologic cycle, i.e., collect hydrologic data, educate and train new personnel, access resources and budget balances, conduct research into problems, and facilitate information exchange (Batisse, 1984). The IHD programs consisted mainly of activities initiated by participating countries, each with a national IHD committee, and coordinated at a global scale by ten working groups (Table 2.6) under the umbrella of UNESCO (UNESCO, 1963).

Table 2.5: IHD working groups as of December 1966

	Working Groups
1	Representative and experimental Basins
2	Hydrology of Carbonate Rocks of the Mediterranean Basin
3	Nuclear Techniques
4	Floods and their computations
5	Exchange of information
6	Education
7	World water Balance
8	Hydrological Maps
9	Influence of Man on the Hydrological Cycle
10	Standardization Problems

Source (UNESCO, 1974)

While the IHD was a global initiative, participation in most of the programs was dominated by developed countries. For example, in 1965, the coordinating council of UNESCO accepted 123 proposed hydrologic activities suitable for international cooperation. From the proposals, only one study from the continent of Africa (Ghana) was accepted, compared to 27 from the USA, 25 from Canada, 15 from Germany, and 10 from the former USSR (UNESCO, 1974). Africa at this time lacked enough personnel to contribute effectively to the objectives of the decade. While UNESCO concentrated on strengthening post-graduate programs in hydrology, the efforts in Africa were geared towards the training of technicians (UNESCO, 1970). Despite a relatively small contribution of African countries to the Decade’s efforts, collaborations with developed countries yielded significant benefits for the continent. One major success of the IHD in Africa was the successful inventory of the water balance in several African water basins (Korzun, 1978). For example, mean annual runoff data were collected for the major rivers (Table 2.7), as well as water balance for the major water basins (Congo, Niger, Nile, and Zambezi) (Korzun, 1978).

Table 2.6: Mean annual run-off in the largest African rivers taken during the IHD 1965-1964.

River	Surface area of the watershed ($10^3 Km^3$)	Mean annual Run-off (Km^3)
Congo	3822	1414
Niger	2090	268
Nile	2870	73.1
Zambezi	1330	106
Ogowe	203.5	149
Sanaga	135	67.9
Volta	394	40.6
Rufidgi (Rufiji)	178	35.2
Kuilu	62	34.7
Kwansa	149	29.8
Juba	750	17.2
Orange	1020	15.3
Senegal	441	23.2
Sassaidza	72	26.1
Limpopo	440	26

Source: (Korzun V. , 1978)

Other significant studies in Africa were carried out under the auspices of the "Representative and Experimental Basin Working Group," in which selected basins all over the world were chosen for a detailed analysis. Lake Chad basin, covering 400,000 square kilometers across four countries (Cameroon, Chad, Niger, and Nigeria), was studied in great detail (Korzun, 1978). A general hydrological survey in the basin started as early as 1960 and was accelerated during the IHD with several UN agencies working together. For example, the Food and Agricultural organization (FAO) was in charge of reclamations (irrigation, pastoral agriculture, stock raising, and fish breeding), UNESCO was in charge of the hydrological survey of the basin including the analysis of surface and underground water, while funding of the study was undertaken by UNDP (Gischler, 1967). Another significant study under the "World Water Balance Working Group" was performed on Mt. Ruwenzori. The study involved a coordinated program for measuring glaciers on the mountain. The results of this study showed that glaciers retreated by 5.5 to 10.5 meters between 1958 and 1966 (Temple, 1968).

Armed with data gained during the decade, the question that lingered within the scientific community was how to use the information to solve the problem of water scarcity that was facing many people. At the end of the IHD in December 1974, the work of the decade was taken over by the International Hydrological Program (IHP), which played a major role in facilitating international conferences to discuss issues related to water in the world (Table 2.5). A notable example was the 1977 UN conference on water in Mar del Plata, Argentina, which ushered in a new water decade, that of the International Drinking Water Supply and Sanitation Decade (IDWSSD).

2.3.2 International Drinking Water Supply and Sanitation Decade (IDWSSD) 1981-1990

The Mar del Plata action plan adopted after the UN conference on water recognized the health consequences of water scarcity in poor countries and stressed the need to give priority to programs that would accelerate access to water and sanitation. At the beginning of this decade, more than half of the population in the third world (excluding China) did not have safe drinking water, and two out of three lacked sanitation services (Agarwal et al. 1981). The situation is estimated to have caused 80% of all sickness in the developing world (Agarwal et al. 1981). This included sickness from drinking contaminated water, water acting as a breeding ground for pests, and diseases caused by lack of washing. About 90% of deaths that occured due to these ilnesses affected children under five years, mostly in Africa and Asia. It is because of this reality that the UN was obligated to act.

Through resolution 35/18 of 1980 the UN General Assembly proclaimed the period 1981-1990 as the IDWSSD, in which all previously un-served populations would get access to water and sanitation services by 1990 (UN, Secretary General, 1990). To achieve this goal, countries were required to: develop national plans and programs for community water supply and sanitation; initiate engineering projects for water supply; accelerate capacity building in the water sector; mobilize public support and participation; establish necessary institutions; and mobilize the necessary funds (UN, Secretary General, 1990). In response to these recommendations, governments around the world increased their efforts in the provision of improved drinking water and sanitation services (as defined in Table 2.8). Consequently, 1,348 million previously un-served persons received improved water access and 748 million received sanitation services by the close of the decade. The success of this initiative was, however, varied. In Africa, for example, the water and sanitation coverage remained less than satisfactory.

During the decade, the population in Africa increased from 452 million in 1980 to 612 million in 1990 (UN, Secretary General, 1990). As a result, the absolute numbers of persons without access to safe drinking water and sanitation actually increased. For example, the number of people without improved drinking water increased from 243 million people in 1980 to 264 million people in 1990, while those without improved sanitation increased from 315 million people in 1980 to 346 in 1990.

Table 2.7: Improved and non-improved services for drinking water and sanitation

	Improved	Non-Improved
Water Supply	Household connection	Unprotected well
	Public standpipe	Unprotected spring
	Borehole	Vendor provided water
	Protected dug well	Bottled water
	Protected spring water	Tanker-truck provided
	Rainwater collection	
Sanitation	Connection to a public sewer	Service or bucket latrine
	Connection to septic system	Public latrines
	Pour-flush latrine	Latrine with an open pit
	Simple pit latrine	
	Ventilated improved pit latrine	

Source: (WHO, 2008).

Many factors hindered successful implementation of the decade's efforts. The first was demographic. Globally, the average rate of population growth was about 1.2% but much higher in the developing countries (2.5%) where the need for water was greatest. In contrast, the rate of increase in water and sanitation services remained flat or even decreased, especially in the developing counties. Migration to urban centers also provided a major obstacle for water and sanitation services. Due to rural urban-migration, an additional 609 million people had to be provided with water and 5.4

million with sanitation each year in order to stay on track to achieving the target (UN, Secretary General, 1990).

The second factor was limited financial resources. The WHO (1981) estimated the cost (depending on technology chosen) to cover the cost of water supply and sanitation in developing countries to be $300-600 million; but the money promised through international aid was not delivered, leaving poor countries to grapple with massive expenses to meet the demand (Sachs & Mcarthur, 2005). Other problems related to cost included high connection costs, inadequate management, operational costs, and poor pricing systems (UN, 1989). Many countries, especially in Africa, lacked sufficient data to formulate effective cost recovery policies and efficient water tariffs, leading to financial problems for local authorities (UN, 1989). Witten (1991) usefully summarized the socio-economic constraints of the decade as escalating oil prices, low economic productivity, high interest rates, debt servicing burden, drought, and political instability.

In 1990, at the close of the IDWSSD, the WHO-UNICEF joint monitoring program reviewed the pace of progress towards achieving the targets and concluded that most nations would not meet the targets. Consequently, the target year was adjusted to the year 2000. At the end of 2000, however, the number of people without access to safe drinking water and sanitation was still high, at 1.2 billion and 3 billion respectively (UNESCO-WWAP, 2003). As a result, more international conferences (see Table 2.5) were convened to develop new strategies for the next decade, and the UN general assembly adopted a resolution designating the years between 2005 and 2015 as the International Decade for Action, Water for Life (IDAWL).

2.3.3 International Decade for Action, Water for Life (IDAWL) 2005-2015

In September 2000, under the auspices of the UN, 189 countries ushered in the new millennium by adopting the UN Millennium Development Goals (Table 2.12). The purpose of the MDGs declaration was to steer the world out of abject and dehumanizing conditions of poverty by the year 2015 (UN, 2000). Goal 7, target 10 of the MDGs seeks to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by the end of the IDAWL in 2015 (http://www.undp.org/mdg/basics.shtml). Given that water scarcity faced over 1.2 billion people regarding drinking water and 3 billion regarding adequate sanitation (WHO/UNICEF, 2008), adoption of radical reforms and good governance was highly recommended (McGranahan, 2003). Water governance is defined as "a range of political, organizational, and administrative processes through which communities articulate their interests, their input is absorbed, decisions are made and implemented, and decision-makers are held accountable in the development and management of water and delivery of water services at different levels of society" (Grover, 2006, p. 221). Governance includes enabling processes, institutional arrangements, and administrative mechanisms, through which stakeholders can forge common ground in water management (GWP., 2003; Rouse, 2007).

At the center of effective governance is a set of principles which guide management practices. Nath & Hens (2003) note that effective water management should embrace principles and resolutions agreed upon in international conferences (Table 2.8) and adopted with success in many countries (Table 2.9). These conferences include; the United Nations Conference on Water (Mar del Plate, 1977); the Dublin Conference (International Conference on Water and Environment, 1992); the Rio Summit (Earth Summit, 1992); the second World Water Forum and Ministerial Conference (the Hague, 2000); the International Conference on Fresh Water (Bonn, 2001); the World Summit on Sustainable Development (Johannesburg, 2002); and the Third World Water Forum (Kyoto, 2003). The common theme stemming from all the conferences is the concept of Integrated Water Resources Management (IWRM).

Table 2.8: Examples of governance principles for water management

Type of Governance	Principles
Dublin Principles	• Fresh water is a finite and valuable resource, essential to sustain life, development and the environment • Water development and management should be based on a participatory approach, involving users, planners, and policy makers at all levels. • Women play a central part in the provision, management and safeguarding of water • Water has an economic value in all its competing uses and should be recognized as an economic good.
Agenda 21	• Full Public Participation • Multi-Sect oral approach to water management • Sustainable water use
Bonn Principles	• The first key is to meet the water security needs of the poor • Decentralization is the key: The local level is where national policy meets community needs • The key to better water outreach is new partnerships • IWRM is needed to bring all water users to the information-sharing and decision-making tables • The essential keys are stronger and better performing governance

arrangement

2.4 Integrated Water Resource Management (IWRM)

IWRM is defined as "a process which promotes the coordinated development and management of water, land, and related resources in order to maximize resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" GWP (2003, p. 14). The definition recognizes water as one of the key issues in sustainable development, and it should therefore be managed in an integrated way to achieve the goals of sustainable development as well as the MDG targets. The fifth WaterNet/Warfsa/ GWP_SA symposium titled "Integrated Water Resources Management (IWRM) and Millennium Development Goals" brought together water professionals from southern Africa to share experiences on how best to improve IWRM, with the main goal of achieving the MDGs (Nhapia, et al., 2005). The symposium recognized that full coverage of water supply and sanitation services was not achieved during the water decade of 1980-1990, and that there was a need for a paradigm shift if the MDGs were to be achieved. The members agreed that IWRM can help harmonize investments in water infrastructure, water allocation, sanitation decisions, and water management, and capitalize on opportunities for synergies and help reconcile different tradeoffs to propel a country towards achieving the goals (Jønch-Clausen, 2004). The aim of IWRM is to replace the one-sided management perspective of a single interest sub-sector to a participatory, multi-sided management of water resources (Van Hofwegen, 2000). In view of the challenges facing the water sector, and the need to achieve the MDGs, it is essential to examine critically and objectively the theory of IWRM and its utility in achieving the MDG water targets.

The Mar del Plata conference laid the groundwork for placing water at center stage in the global discourse, and advocated a change from single-minded, single-sector planning and management of water resources to IWRM as a new paradigm (Rahaman, Varis & Kajander 2004; Merrey, 2008). IWRM recognizes the fact that water management is often fragmented among various agencies and institutions, with little attention paid to conflicts and complementarities among social, economic, and environmental objectives (Mitchell, 2005). Different agencies deal with different water uses, e.g., irrigation, municipal (domestic) water supply, power, industrial, and wildlife. Under such a fragmented scheme, concerns with respect to water quality, quantity, and health would therefore be handled separately leading to disjointed and uncoordinated solutions. The paradigm shift represents a break from the "modernity paradigm" (Allan J. , 2005), in which the emphasis was finding new sources of water supply, to a greater emphasis on demand management.

The premise behind IWRM is that changes in one part of the water system (e.g., pollution) have consequences for other parts of the system and that these effects should be accounted for to ensure fair and equitable distribution of water. Turton et.al. (2007) note that the acceptance of IWRM by many countries (Table 2.10) is due to recognition that all components of the water cycle should be manageged as a single unit and that all stakeholders should be invoved in decision-making to ensure aceptance and legitimacy. It is a recognition that loose institutional arrangements of inter-linked water sectors can only suffice under conditions of water surplus and when conflicts and enviromental degradation are minimal (Frederiksen, 1992). The transition to IWRM requires suitable political, social, economic, and administrative tools to expedite the process.

Despite the fact that holistic water management is an old concept and has been practiced in Europe, America, Australia, Mexico and other countries, who still have internal conflicts (Biswas, 2004; Mitchell, 2005), the current conventional definition of the concept derives its meaning from the Dublin Principles (adopted in 1992) (Table 2.9) and which form the cornerstone of most water reform strategies in many countries (UNESCO-WWAP, 2003). Agenda 21 of the subsequent meeting, held in Rio in 1992, reinforced the Dublin Principles by further noting that " The widespread scarcity, gradual destruction, and aggravated pollution of freshwater resources in many world regions, along with the progressive encroachment of incompatible activities, demand integrated water resources planning and management" (www.un.org/esa/sustdev/documents/agenda21).

Based on these conferences, the World Bank, regional development banks, and many bi-lateral donors have adopted the principles of IWRM as a condition for funding water projects in developing countries (Merrey, 2008). The World Bank in particular demands that water be treated as an economic good, with effective pricing and decentralized water management (Lankford, 2008).The Inter-American Development

Bank (IDB) has gone even further and developed a strategy for IWRM which lays down the necessary conditions for borrowing member countries (Van Hofwegen, 2000). Accordingly, many countries have adopted the IWRM concept and reformed their institutional arrangements to reflect this reality (Table 2.10).

2.4.1 Elements of IWRM

The concept of IWRM is based on a principle of integration, which is a process of blending the right proportions of human and natural systems to achieve economic efficiency of water use, equity in water utilization, and environmental/ecological sustainability (Table 2.11) (GWP., 2003).

Table 2.9: Status of IWRM adoption by 2006

Region	IWRM Adoption Level			Total
	Advanced	Moderate	Initial stages	
Africa				
North Africa	0	3	2	5
Central Africa	0	1	4	5
Eastern Africa	1	4	3	8
West Africa	1	6	1	8
Southern Africa	3	7	2	12
Regional total	**5**	**21**	**12**	**38**
Asia & Oceania				
China	1	0	0	1
Central Asia & Caucasus	2	4	2	8
South Asia	1	4	1	6
South east Asia & Oceania	2	3	3	8
Regional total	**6**	**11**	**6**	**23**
Europe				
Central & Eastern Europe	7	3	0	10
Regional total	**7**	**3**	**0**	**10**

Latin America				
Central America	0	5	2	7
South America	1	5	3	9
Regional Total	**1**	**10**	**5**	**16**
Small island States				
Pacific	1	2	2	5
Caribbean	0	3	0	3
Regional total	**1**	**5**	**2**	**8**

Source: (GWP, 2006)

Table 2.10: Natural and human system integration in IWRM.

Natural System Integration	**Human System Integration**
Fresh water and coastal zone management	Mainsteaming of water resources
Land and water management	Cross-sectoral integration of water policies
"Green water" and "blue water" management	Integrate stakeholder planning & decisions
Surface water and ground water	Integration of water & waste water management
Quantity and quality of water	
Upstream and downstream inerests	

An effective IWRM process can contribute to achieving MDGs if it is enshrined within three general principles: Enabling environment; institutional framework; and management instruments (Figure 2.2). Enabling environment includes national policies, legislations and financial management of water resources; institutions define functions of various agencies at different levels and management instruments include operational strategies that include regulation, monitoring, and enforcement of water related policies. Effective integration of interests and activities through IWRM, can foster efficient and sustainable access to safe and secure water to achieve not only water access and sanitation targets but also fast track the achievement of all the other MDG's. Water is a fundamental ingredient for production, and clearly production is a factor in poverty reduction. Effective IWRM should contribute to institutional arrangements that encourage investiments in irrigation infrastructure which in turn could lead to development. IWRM will also contribute to reduction of water related diseases, which are a cause of many deaths in most developing countries. IWRM could also foster environmental sustainability by encouraging conservation, protection and restoration of water resources (Jønch-Clausen, 2004).

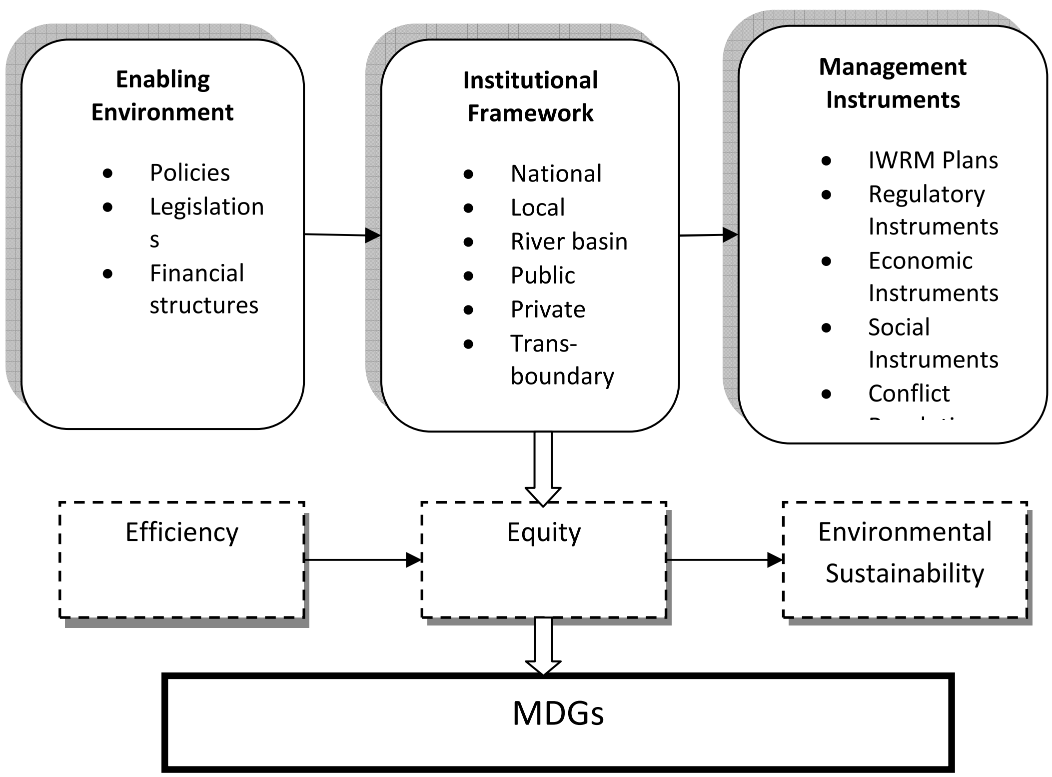


Figure 2.2: The pillars of IWRM (Adapted from (Jønch-Clausen, 2004).

Overall, IWRM provides an avenue for coordinating and harmonizing different demands for water resources required to achieve the MDGs (Table 2.12). Properly developed, IWRM can become an efficient tool that progresively identifies strategies and actions in water resource management, water insfrastructure development, improved water efficiency, and provision (Jønch-Clausen, 2004).

The concept of IWM has however elicited heated debate in many parts of the world. Many advocates of the model base their arguments on the successful application of IWRM in developed countries; yet, according to many critics, there are few successful examples of transferability of such models in developing countries (McGranahan, 2003; Van der Zaag, 2005; Lankford, 2008; Merrey, 2008). While enormous success in water and sanitation coverage has been witnessed in many parts of the world (Table 2.9), developing countries, especially in Africa, still lag behind (Figure 2.3). Biswas (2004) and Merrey (2008) question whether IWRM is actually a relevant concept in developing nations or just a ”buzzword”. They concur that while the concept is theoretically sound, it fails as an operational guide both at the planning and impementation levels. Allan (2003), for example, notes that the concept has been developed in the context of the developed North, and is being pressed to the South which has not completed its “hydraulic mission”. Merrey (2008) observes that effective water policies and institutional arrangements cannot be considered universal, but rather crafted based on social, economic, political, and environmental contexts of the particular basin. Biswas (2004) notes that the IWRM concept has been around for 60 years, with a dubious record of implementation, because it lacks clear guidelines for such and has an ambiguous definition. He further states that because of popularity of the model, many countries continue doing what they have been doing under this concept in order to attract funds and obtain greater global acceptance. Mitchel (2004), however, notes that IWRM provides a framework for different types of approaches identified through stakeholder participation. Swatuk (2002) recognizes the limitation IWRM poses in a political sense by focusing on hydrological boundaries rather than political bounderies.

In water scarse countries especially, water management is about allocation, which is a hot political issue and one that may involve a zero-sum game. In such a situation, many stakeholders will feel disenfranchised and therefore lack the political will to participate in water management (Van der Zaag, 2005). Allan (2003) therefore states that IWRM will be successful only if the inherent political nature of water is addressed. Frederiksen(1992), in a World Bank report, notes that effectiveness in water management is determined by political processes. The Global Water Partnership (GWP, 2003), the agency behind IWRM, admits that its definition is ambiguous and that national institutions should develop their own IWRM based on prevailing conditions. In this sense, many “shades” of IWRM have been promoted by different scholars to mitigate these problems. These include Integrated Water Resource Allocation and Management (Allan, 2003), Expedient Water resource Mnagement (Lankford , 2008), and Model for Ecosystem Governance (Turton, et.al., 2007).

Table 2.11: Water and Millennium Development Goals.

Millennium Development Goal by 2015	Contribution of Improved Water Resources Management and Access to Water Supply and Sanitation
Poverty **To halve the proportion of the world's people whose income is less than $1/day**	• Water is a factor of production in agriculture, industry and other economic activities • Investments in water infrastructure/services as a catalyst for local/regional development • Reduced vulnerability to water-related hazards reduces risks in investments and production • Reduced ecosystems degradation makes livelihood systems of the poor more secure • Improved health increases productive capacities, reduces burden on those who care for the sick
Hunger **To halve the proportion of the world's people who suffer from hunger**	• Water is a direct input to irrigation for expanded grain production • Reliable water for subsistence agriculture, home gardens, livestock, tree crops • Sustainable production of fish, tree crops and other foods gathered in common property resources (also affects poverty when such goods are sold for income) • Reduced urban hunger due to cheaper food prices • Healthy people are better able to absorb the nutrients in food than those suffering from water-related diseases, particularly worms.
Primary Education **To ensure that children everywhere complete a full course of primary schooling**	• Improved school attendance from improved health and reduced water-carrying burdens, especially for girls • Having separate sanitation facilities for girls and boys in schools increases girls' school attendance
Gender Equality **To ensure girls and boys have equal access to primary and secondary education**	• Community-based organizations for water management improve social capital of women • Reduced time, health, and care-giving burdens from improved water services give women more time for productive endeavors, adult education, empowerment activities, leisure • Water sources and sanitation facilities closer to home put women and girls at less risk for sexual harassment and assault while gathering water and searching for privacy • Higher rates of child survival are a precursor to the demographic transition toward lower fertility rates; having fewer children reduces women's reproductive responsibilities
Child Mortality **To reduce by two-thirds the death rate for children under five**	• Improved quantities and quality of domestic water and sanitation reduce main morbidity and mortality factor for young children • Improved nutrition and food security reduces susceptibility to diseases
Maternal Mortality **To halve, halt and begun to reverse the spread of HIV, malaria, other major diseases**	• Improved health and reduced labor burdens from water portage reduce mortality risks • Improved health and nutrition reduce susceptibility to anemia and other conditions that affect maternal mortality • Sufficient quantities of clean water for washing pre-and-post birth cut down on life –threatening infections

	• Higher rates of child survival are a precursor to the demographic transition toward lower fertility rates, and fewer pregnancies per woman reduce maternal mortality
Major Disease **To halve, halt and begun to reverse the spread of HIV, malaria, other major diseases**	• Better water management reduces mosquito habitats • Better water management reduces incidence of a range of other water-borne diseases • Improved health and nutrition reduce susceptibility to/severity of HIV/AIDS and other major diseases
Environmental sustainability **To stop the unsustainable exploitation of natural resources and to halve the proportion of people who are unable to reach or afford safe drinking water**	• Improved water management, including pollution control and water conservation is a key factor in maintaining ecosystems integrity • Development of integrated management within river basins creates situation where sustainable ecosystems management is possible and upstream-downstream effects are mitigated • Biodiversity conservation, combating desertification furthered by sound water management

Note. from (Jønch-Clausen, 2004)

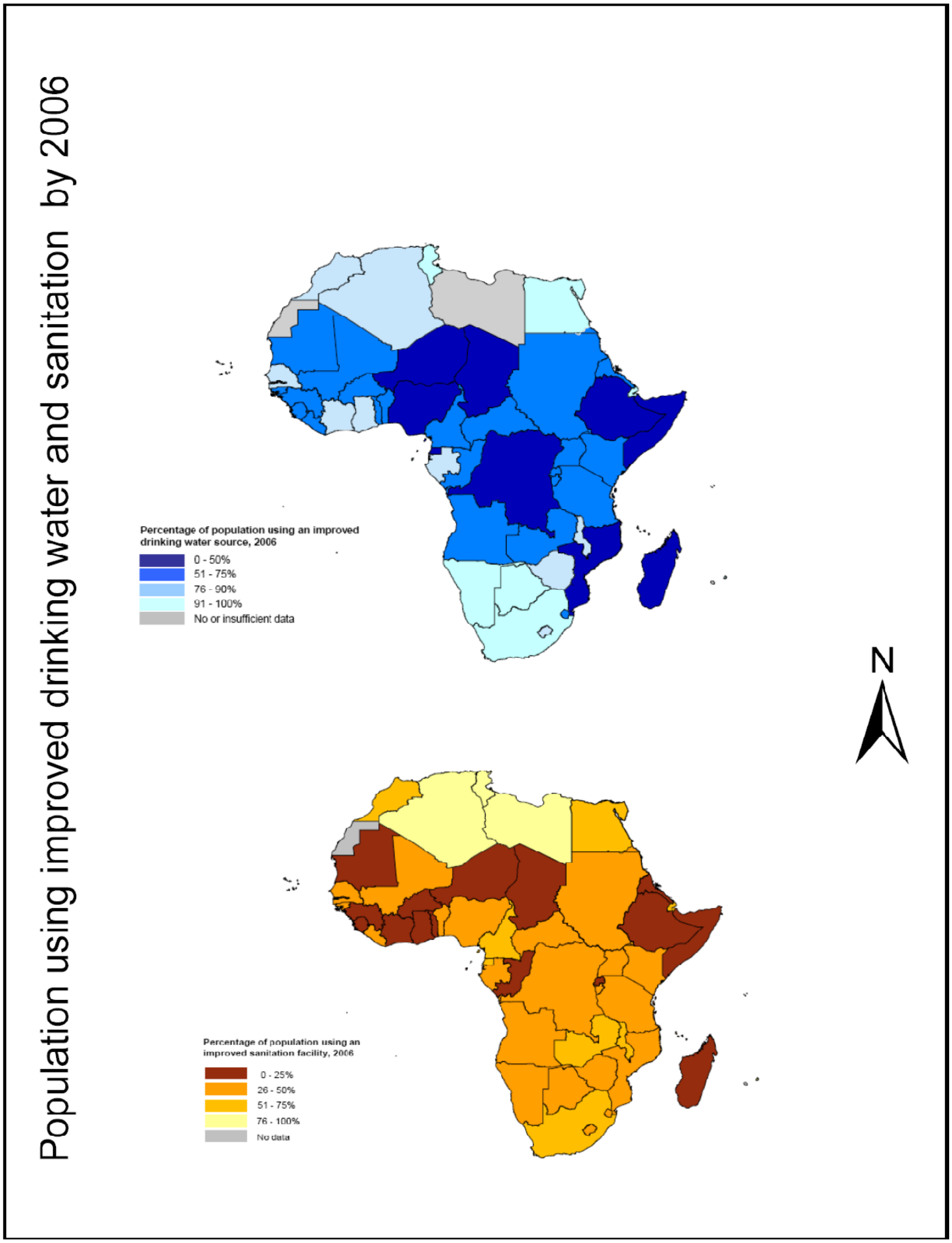


Figure 2.3: Improved drinking and sanitation coverage by 2006 (WHO-UNICEF, 2008).

Table 2.13: Global Progress towards achieving MDGs between 1990 and 2006

Drinking water and sanitation coverage: regional estimates by type of drinking water and sanitation facilities (1990 and 2006)

MDG regions and the world	Year	Population		Drinking water coverage (%)													Sanitation coverage (%)												
				Urban				Rural				Total					Urban				Rural				Total				
		Total (thousands)	Urban (%)	Improved	Piped into dwelling, yard or plot	Other improved	Unimproved	Improved	Piped into dwelling, yard or plot	Other improved	Unimproved	Improved	Piped into dwelling, yard or plot	Other improved	Unimproved	% of population that gained coverage (1990-2006) with respect to median population (Year 1998)	Improved	Shared	Unimproved	Open defecation	Improved	Shared	Unimproved	Open defecation	Improved	Shared	Unimproved	Open defecation	% of population that gained coverage (1990-2006) with respect to median population (Year 1998)
Sub-Saharan Africa	1990	519,388	28	82	46	36	18	35	4	31	65	49	16	33	51	37	40	27	22	11	20	9	25	46	26	14	24	36	19
	2006	788,214	36	81	35	46	19	46	5	41	54	58	16	42	42		42	31	19	8	24	11	26	39	31	18	23	28	
Northern Africa	1990	118,032	49	95	83	12	5	82	34	48	18	88	58	30	12	35	82	6	10	2	44	5	21	30	62	5	17	16	32
	2006	155,087	54	96	91	5	4	87	63	24	13	92	78	14	8		90	6	4	0	59	7	25	9	76	6	14	4	
Eastern Asia	1990	1,220,373	30	97	82	15	3	55	37	18	45	68	51	17	32	33	61	12	24	3	43	1	51	5	48	4	44	4	25
	2006	1,402,837	43	98	87	11	2	81	62	19	19	88	73	15	12		74	15	7	4	59	1	38	2	65	7	25	3	
Southern Asia	1990	1,192,558	26	91	55	36	9	68	8	60	32	74	20	54	26	39	53	17	6	24	10	2	7	81	21	6	8	65	19
	2006	1,612,840	30	95	51	44	5	84	10	74	16	87	22	65	13		57	20	8	15	23	6	8	63	33	10	9	48	
South-eastern Asia	1990	440,574	32	92	41	51	8	64	4	60	36	73	16	57	27	36	74	8	6	12	40	4	21	35	50	5	17	28	36
	2006	565,105	45	92	53	39	8	81	14	67	19	86	32	54	14		78	8	4	10	58	5	13	24	67	7	8	18	
Western Asia	1990	137,541	62	95	82	13	5	70	50	20	30	86	69	17	14	54	93	6	1	0	56	2	24	18	79	4	10	7	63
	2006	200,205	66	95	93	2	5	80	57	23	20	90	80	10	10		94	6	0	0	64	4	18	14	84	6	5	5	
Oceania	1990	6,449	23	92	-	-	8	39	7	32	61	51	-	-	49	15	80	-	20	-	44	1	34	21	52	-	48	-	17
	2006	9,175	24	91	-	-	9	37	6	31	63	50	-	-	50		80	-	20	-	43	1	36	20	52	-	48	-	
Latin America & Caribbean	1990	444,277	71	94	84	10	6	61	25	36	39	84	67	17	16	26	81	6	7	6	35	3	19	43	68	5	10	17	25
	2006	565,049	78	97	90	7	3	73	48	25	27	92	80	12	8		86	6	6	2	52	4	21	23	79	6	8	7	
Commonwealth of Independent States	1990	281,428	65	97	86	11	3	84	42	42	16	93	71	22	7	12	95	-	5	-	81	-	19	-	90	-	10	-	10
	2006	278,255	64	99	90	9	1	86	42	44	14	94	73	21	6		94	-	6	-	81	3	16	-	89	-	11	-	
Developed regions	1990	934,265	71	100	98	2	0	95	73	22	5	98	91	7	2	15	100	-	0	0	96	-	4	-	99	-	1	-	12
	2006	1,016,093	75	100	98	2	0	97	78	19	3	99	93	6	1		100	-	0	0	96	-	4	-	99	-	1	-	
Developing regions	1990	4,079,192	35	93	69	24	7	59	19	40	41	71	36	35	29	35	66	12	12	10	28	3	27	42	41	6	22	31	25
	2006	5,298,512	43	94	70	24	6	76	27	49	24	84	46	38	16		71	15	7	7	39	5	21	35	53	9	15	23	
World	1990	5,294,885	43	95	79	16	5	63	24	39	37	77	48	29	23	31	78	8	8	6	36	3	24	37	54	5	17	24	22
	2006	6,592,900	49	96	78	18	4	78	31	47	22	87	54	33	13		79	11	5	5	45	5	19	31	62	8	12	18	

Source: (WHO-UNICEF, 2008)

2.5 Conclusion

Water scarcity is a multi-dimensional phenomenon that involves both the physical availability of water including its quality, as well as institutional aspects of water supply. Scholars tend to discuss water scarcity at a nation-state and to a lesser extend in regions or smaller geopolitical units. This could be attributed to lack of data at a regional level or the belief that water provision is, or should be, the responsibility of the nation state. Physical water scarcity is defined as a situation where demographically induced demand for water exceeds the current level of water availability, in which case, scarcity is measured in per capita water availability, or use-to-resource ratio indices. Water scarcity can also occur due to institutional inefficiencies, such as economic institutional failures, management failures, as well as political and social failures. For example, economic scarcity occurs when people or a country lack resources to make water available to them, or because economic instruments disenfranchise the poor, especially those living in rural and urban slum areas. Political and managerial scarcities on the other hand occur when people lack water because of political subordination or poor management. At the beginning of the 21st century in 2000, 1.2 billion people lacked safe and sufficient water while 3 billion lacked sufficient sanitation services. Ten years later, this figure stands at 894 million without safe and secure water and 2.6 billion without safe and adequate sanitation services.

Given the challenge of water scarcity to human survival and welfare, global initiatives to promote or assure access to water have been championed primarily by the

United Nations. These initiatives represent globalized agendas, where the UN and other international agencies shape the national and international water policies as well as water management process.

The International Hydrological Decade (IHD), was a global initiatives meant to strengthening the connections between scientific research, application, and education in the water sector between 1965-1964. The goals of the decade would be achieved through five key objectives geared towards understanding the hydrologic cycle, i.e., collect hydrologic data, educate and train new personnel, access resources and budget balances, conduct research into problems, and facilitate information exchange. Despite the global focus of IHD, participation in most of the programs was dominated by developed countries. Africa for example lacked enough personnel to contribute effectively to the objectives of the decade. While developing countries concentrated on strengthening post-graduate programs in hydrology, the efforts in Africa were geared towards the training of technicians. One major success of the IHD efforts in Africa was the successful inventory of the water balance in several African water basins such as the Congo, the Nile and Niger.

Another major global initiative was the International Drinking Water Supply and Sanitation Decade of 1981-1990 (IDWSSD). The goal of the decade was to ensure universal access to safe and sufficient drinking water by 1990. Countries were required to: develop national plans and programs for community water supply and sanitation; initiate engineering projects for water supply; accelerate capacity building in the water sector; mobilize public support and participation; establish necessary institutions; and mobilize the necessary funds to achieve the target. This ambitious target was however not achieved by 1990. The failure was attributed to many factors including population increase, limited financial resources, escalating oil prices, low productivity, massive debts, droughts and political instabilities.

Failure to meet the target during the previous water target resulted, in accelerated global discourse in major international conferences culminating with the UN general assembly designating the years between 2005 and 2015 as the International Decade for Action, Water for Life (IDAWL), in which the MDGs would be achieved. The MDGs are sets of goals and targets meant to steer the world out of abject and dehumanizing conditions of poverty by the year 2015 (UN, 2000). Goal 7, target 10 of the MDGs seeks to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by the end of the IDAWL in 2015. Achievement of this target called for adoption of radical reforms and good governance including change from single-minded, single-sector planning and management of water resources to IWRM as a new paradigm. Scholars in support of the model believe that IWRM provides an avenue for coordinating and harmonizing different demands for water resources required to achieve the MDGs, however others believe that IWRM is a Western concept forced on developing countries who have an entirely different set of social, political and economic environment.

Based on such disagreements, IWRM should be viewed as a process under evolution and not as a one-time goal to be achieved (Mohile, 2005). Molinga et. al.

(2006) note that IWRM can seen as a boundary concept that allows different players to attach different meanings and management design to it. Boundary concept in this case refers to the ability of IWRM to adapt to local needs and constraints, yet at the same time maintain a common identity across the site. Whereas the Dublin Principles which are the center piece of IWRM, are universally accepted as guiding principles, the environments in which these principles are implemented provide different challenges and require different policy guidelines, institutional arrangements, and management structures.

Chapter Three: Research Design

3.1 Approach

Kenya was chosen as a case study (Section 1.4) because it provides a good example of historical water reforms and a new water reform policy whose theoretical content and practical implementation need to be assessed in the interests of improving water access for Kenya's citizens. The research uses mixed methods to obtain and analyze data and information against which the policy and its implementation can be evaluated. The methods include: archival research; a questionnaire survey; and data envelopment analysis (DEA) of water provision statistics using Water Service Providers (WSP) as the unit of interest.

It is becoming increasingly apparent (Brannen, 1992) that mixed methods research, provided that the qualitative and quantitative components can be properly integrated (Creswell, 2003), can help enhance knowledge through a synergistic effect, what O'Cathain et al. (2007) refer to as the "interaction or conversation" between the components. There are several strengths of mixed-method designs (Greene et al. (1989). Of particular relevance to this current study are: (1) Complementarity – results and concepts revealed in one method are illustrated using another; (2) Contradictions – conflicts in the findings between different methods may require an exploration of how the accounts are arrived at; and (3) Elaboration or expansion – allows detail, richness, and depth in the findings to be generated (Greene et al. 1989; Brannen, 1992).

The first research task involved a literature review and archival research to set the wider (international, theoretical) context of water reform. The second objective required both archival research and a questionnaire survey to gain an understanding of the dynamics of recent water reform and water access in a country-specific setting. Finally, the third objective required statistical analysis of water provision and access data at regional/local scales to assess target attainment regarding water supply efficiency. The qualitative methods help to embrace, rather than remove, context (Devine & Heath 1999). Context is important in understanding past and present water reforms in Kenya. Methods based on the analysis of quantitative data, on the other hand, enable precise evaluations to be made of the status of natural and human systems; in this case, of the efficiency of water service providers and the degree to which they are meeting water access targets.

In addition, the objectives (presented in section 1.3.2) are progressive: the first sets the context for the second, which sets the context for the third. In this way, the geographic and conceptual scales of interest reduce through the study (see left-hand part of Figure 1.1): from a global scale (international/global water governance principles, including IWRM), to a national scale (management policies and legal framework), to a basin scale (efficiency of water service providers). In this way, therefore, the progression of research objectives and the integration of research methods coincide to provide an opportunity to develop an understanding of the historical evolution of water reform and water access in Kenya, including the driving factors behind water reform, the interconnections between reform and access, and the present and anticipated progress with respect to improving water access (MDGs).

3.2 Study Area

3.2.1 Physiography and Climate

The Republic of Kenya is located in East Africa, between latitudes 4^0 21′ N and $4^0$28′ S and longitudes 34^0 10’ E and 42^0 00’ E (Fig. 3.1a). It shares boundaries with Uganda to the west, Tanzania to the south, Ethiopia and Sudan to the north, and Somalia to the east. Kenya is also bordered to the southeast by the Indian Ocean. With an area of about 583,000km^2, water occupies 11,230km^2 (1.92%) leaving 568,770km^2 of dry land, of which 80% is considered as either arid or semi-arid lands (ASAL, Fig. 3.1b) (Ojany & Ogendo, 1987). The country is composed of diverse topographic regions ranging from the highest mountains in Africa (Mt. Kilimanjaro at 5895 m (19342 ft), and Mt Kenya at 5199m (17657 ft)) to lowland areas along the coast (<500 feet above sea level), and the Lake Victoria region to the west (Figure 3.2). The Great Rift Valley divides the country into the eastern and the western highlands. The floor of the valley features an internal drainage system with the lowest sections of the basins filled with rift valley lakes (Baringo, Bogoria, Nakuru, Elementaita, Logopi, Naivasha Magadi, and Turkana), as well as volcanic plugs and cones (Mt. Suswa, Mt. Longonot, and Mt. Menengai).

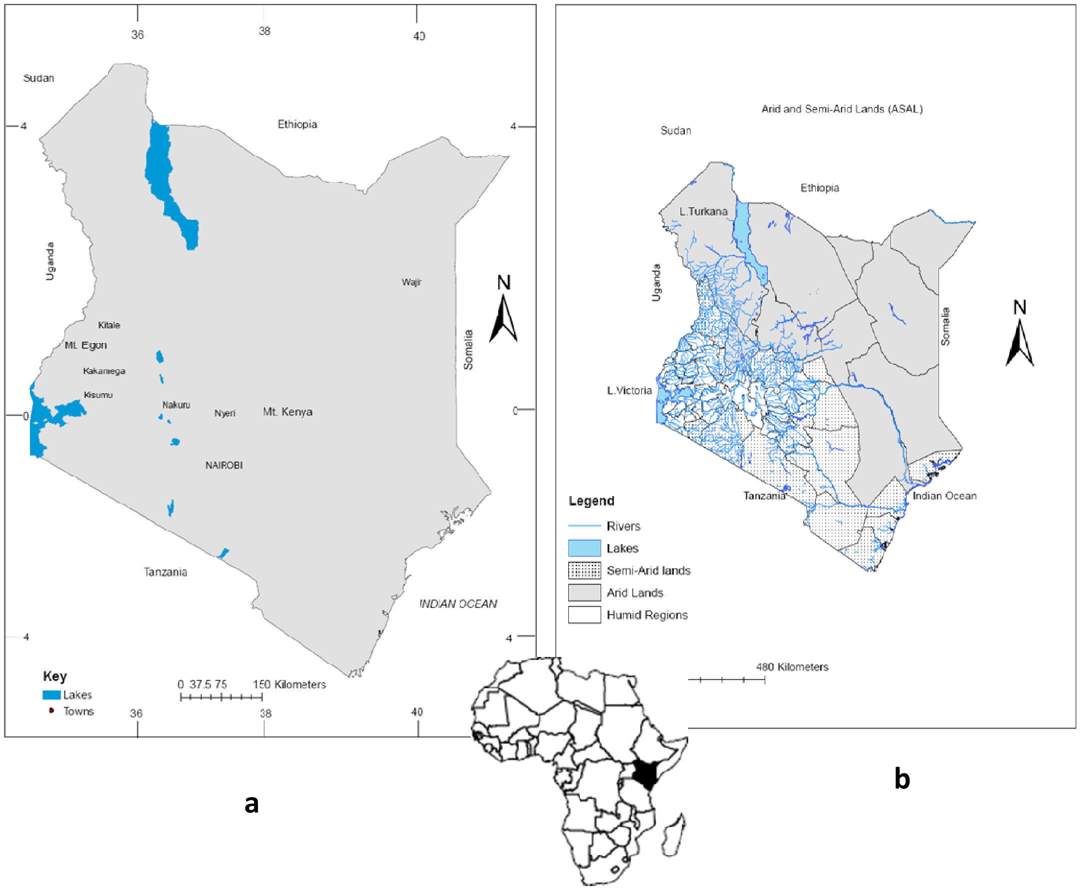


Figure 3.1: (a) Location map of Kenya; (b) Arid, semi-arid, and humid regions.

The climatic conditions in Kenya are as varied as its topography (Figure 3.3). The conditions range from tropical climatic conditions in the central and western part of the country to arid and semi-arid in the northern part. The annual average temperature ranges from 40^{0}C (104^{0}F) in the low altitude coastal strip and the Arid and Semi-arid Lands (ASAL) regions, to below freezing on top of Mt. Kenya and Mt. Kilimanjaro (Ojany & Ogendo, 1987). The average annual rainfall is approximately 630mm, with a spatial distribution ranging from 250mm in the north and northeastern regions to about 2000mm in the central and western lake regions (Figure 3.4). This spatial pattern is the result of the seasonal migration of the Intertropical Convergence Zone (ITCZ). This low pressure zone moves over the country twice a year (March and September), creating a convergence of Southeast and Northeast trade winds, which are responsible for the bimodal rainfall regime commonly known as *long rains* (March-May) and *short rains* (October-December) as shown in Figure 3.3 for various localities.

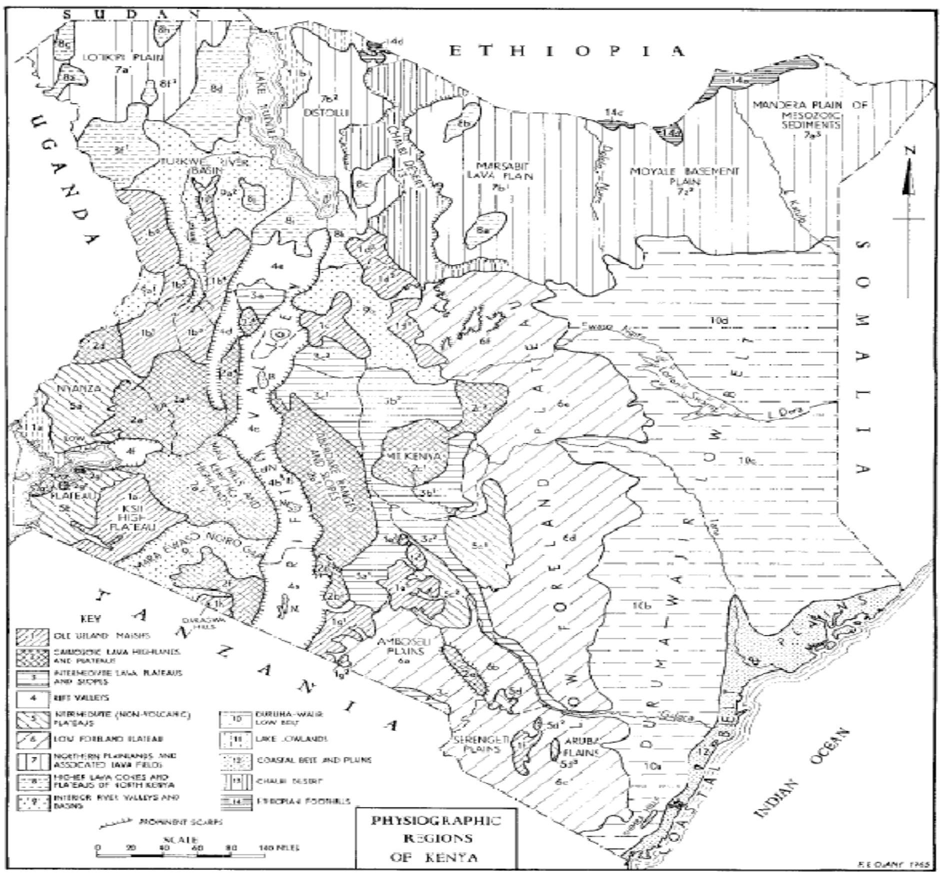
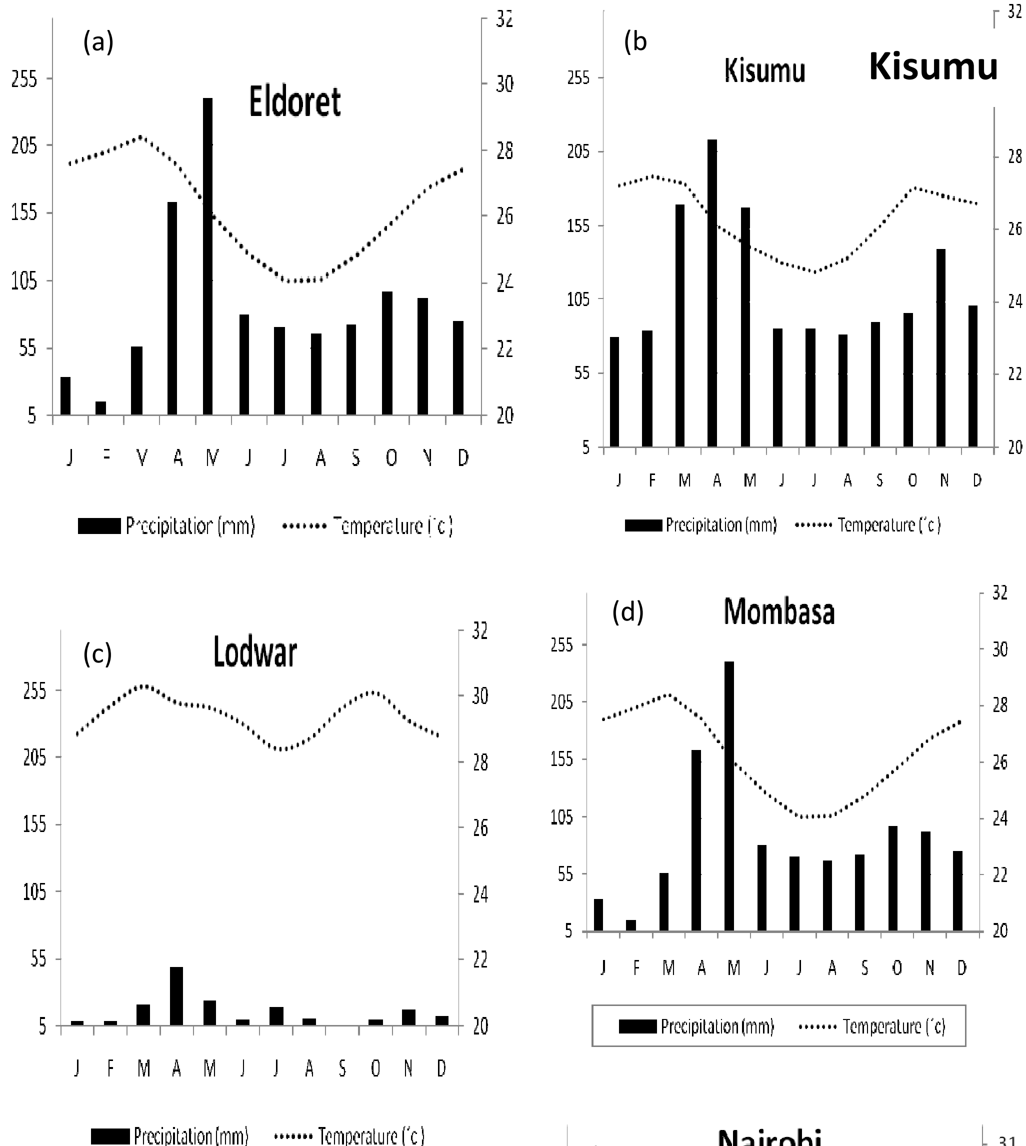


Figure 3.2: Physiographic regions of Kenya. Source (Ojany & Ogendo, 1987).



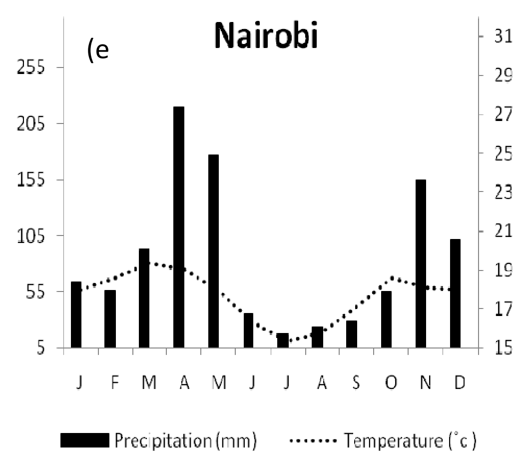


Figure 3.3: Spatial variation of rainfall and temperature for (a) Eldoret in the western region, (b) Kisumu in the Lake region, (c) Lodwar in the northern ASAL region, (d) Mombasa in the

In Kenya, the heaviest rainfall occurs in Lake Victoria and central regions. In the Lake Victoria region, the total annual rainfall exceeds 2000 mm due to the unstable Congo air stream, orographic effects, and lake influence. This region has no dry month, and rainfall is concentrated in two seasons. The first is the long rainy season which lasts from March to May, with a maximum of 200 mm. The second is the short rains which starts from August to November with a maximum of 140 mm in November (Figure 3.3 a). The central region also has two rainy seasons. The long rains last from March to May with a maximum of about 200mm in April, while the short rains last from October to December with a maximum of 155 mm in November (Figure 3.3 e). Rainfall reduces with distance from the Central region, reaching an average of 1000 mm annually along the coastal region (Figure 3.3 d). In this region, the season is unimodal and distribution is confined between March to May, with a maximum of 240mm in May. Further north, along the Sudan and Somali borders, the total rainfall diminishes to less than 200 mm per year (Figure 3.3 e) and occurs during the three-month period from March to May. These patterns, combined with the topography of the country, determine water availability in different water basins, for which there is wide variability.

The presence of large water bodies, like the Indian Ocean and Lake Victoria, has a significant climatic effect on local areas by acting as agents of thermal regulation through the production of sea and land breezes (Leroux, 2001). During the night, cold air (sea breeze) moves from the lake to replace rising warm air over the land. As the cool moist air from the sea meets the warm air from the adjacent land, a cold front forms, leading to the development of cumulus clouds which may trigger thunderstorms. On the

Indian Ocean shores of the country, the inland progression of the breeze front reaches up to 150 km, creating a convergence that brings storms at night over the ocean (land breeze), and inland in the afternoon (sea breeze) (Camberlin & Planchon 1997). Along the eastern and southern shores of Lake Victoria, the common easterly winds meet the land breeze, bringing about a subsidence of air leading to rainfall. Asani (1993) found that these processes increase rainfall by 30-35% in the lake region compared to sorrounding areas (Figure 3.3b).

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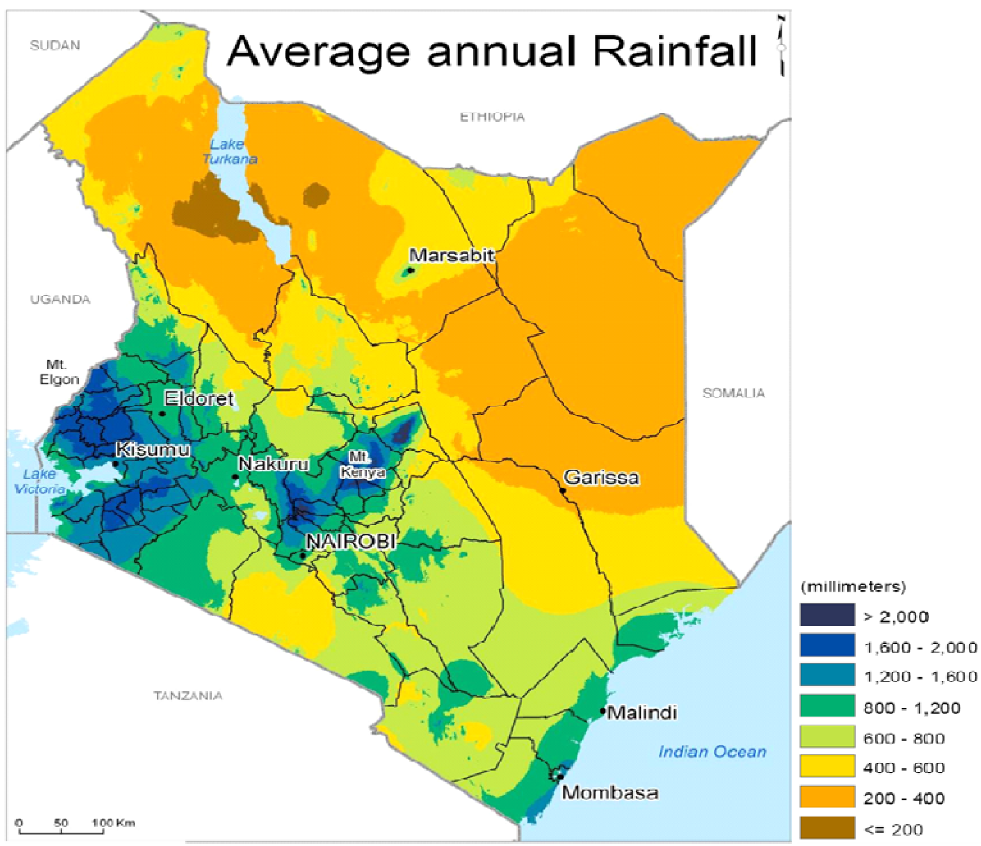


Figure 3.4: Kenya average annual rainfall totals.

3.2.2 Water availability, spatial distribution, and access

Kenya's water budget analysis shows that the water comes from an estimated average annual rainfall volume of 322.77 billion cubic meters (BCM), translating to an annual runoff of 21.8 BCM (of which 19.7 BCM (90.3%) contributes to surface water and 2.1 BCM (9.4%) contributes to ground water), while some is lost through evaporation (NWMP, 1992). A small portion of this amount, otherwise known as safe yield (Magoka et al. 2006), can be exploited, the remainder is inaccessible due to physical, economic, and environmental constraints (Table 3.1). Safe yield is the maximum dependable amount of water that can be made available over a given period of time without depleting that source beyond its ability to be naturally recharged. The safe yield from surface water is estimated at 7.4 BCM per year (37% of surface runoff or 20.249 million cubic meters per day) while safe yield from ground water is estimated at 1.0 BCM per year (47% of ground water) (Tuinhof, 2001). Lake Victoria has a safe surface water potential of about 12.00 million cubic meters per day and an additional 539,000 cubic meters per day from ground water, making the highest single contribution of 54.1% of the total national average (Table 3.1). The Rift Valley basin makes the lowest contribution, 797,000 m^3 (4.3%), to the national water potential. In 2001, Kenya's withdrawals from both surface and ground water sources were far below the safe yields. The approximate withdrawal from surface water was 1.1 BCM per year while ground water withdrawals were estimated at 180 million cubic meters per year (Tuinhof, 2001).

Table 3.1: Safe yield by major Drainage Basins in Kenya Source: (Magoka, et al. 2006).

Safe yield in '000 cubic meters per day						
Basin	Surface water in '000 m^3	% of national surface potentials	Ground water In '000 m^3	% of national ground potential	Total In '000 m^3	% of total national water potentials
Lake victoria Basin	11,993	59.2	539	18.7	12,532	54.1
Rift Valley	211	1.0	586	20.3	797	3.4
Athi River	582	2.9	405	14.0	987	4.3
Tana River	6,789	33.5	685	23.8	7,474	32.3
Ewaso Ng'iro	674	3.3	663	23.0	1,337	5.8
Totals	20,249	100	2,878	100	23,127	100

3.2.2.1 River Networks and Basins

The river network configuration in Kenya is such that the network density is highest in the west and central regions where rainfall is heaviest (Figure 3.5). Furthermore, the drainage pattern is centripetal, with nearly all the rivers taking their rise from five mountain or mountain ranges; the so called water towers (Table 3.2). These include Mt. Kenya, the Aberddare Ranges, the Mau Complex, Mt. Elgon, and the Cherangani Hills. Mt Kenya, for example, is the source of the 1050 km long River Tana with a drainage basin of 95,430 km^2. With an annual average discharge of 750 m^3/s, River Tana is the largest river in the country and supports both irrigation and hydro-power plants. The Mau complex is the source of the 198 km long River Mara, with a drainage basin of 9,574 km^2. This river supports wildlife in Masai Mara and Serengeti National Parks. The Mau complex is not only a source of drinking water for people in the central Rift Valley region but also a source of water for Lake Nakuru, which is a major tourist attraction. Table 3.2 describes the rivers originating from each tower and these rivers are mapped in figure 3.6.

Table 3.2: The main water towers in Kenya

Water Tower	Area	Main Rivers
Mau Complex	4000 km^2	Nzoia, Mara, Yala, Nyando, Sondu.
Aberddare Forest	2500 km^2	Tana, Athi, Ewaso Ng'iro, Malewa.
Mt. Kenya Forest	2200 km^2	Tana, Ewaso Ng'iro.
Cherangani Forest	1200 km^2	Nzoia, Kerio, Turkwel.
Mt. Elgon	737.06 km^2	Nzoia, Turkwel.

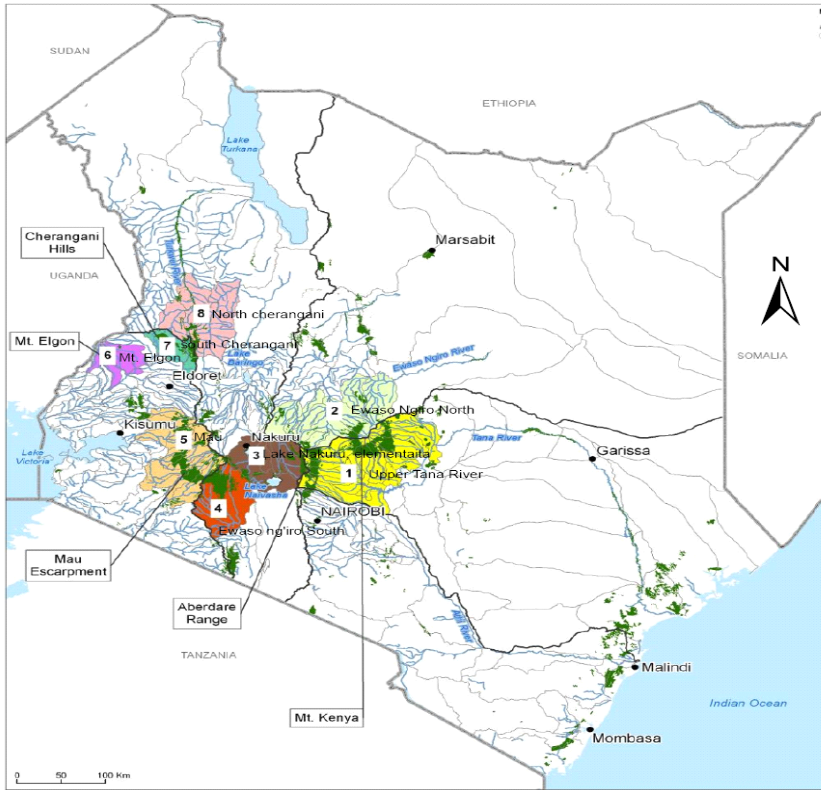


Figure 3.5: The five main water towers in Kenya (World Resources Institute, 2007).

The country's surface water is divided among the five main drainage basins (Figure 3.6 and Table 3.3). Lake Victoria Basin has the smallest area coverage (46,000 km^2), with the greatest concentration of rivers. It contains more than 50% of the total national surface water resources, while the Rift Valley Basin has just 3.4% of the total.

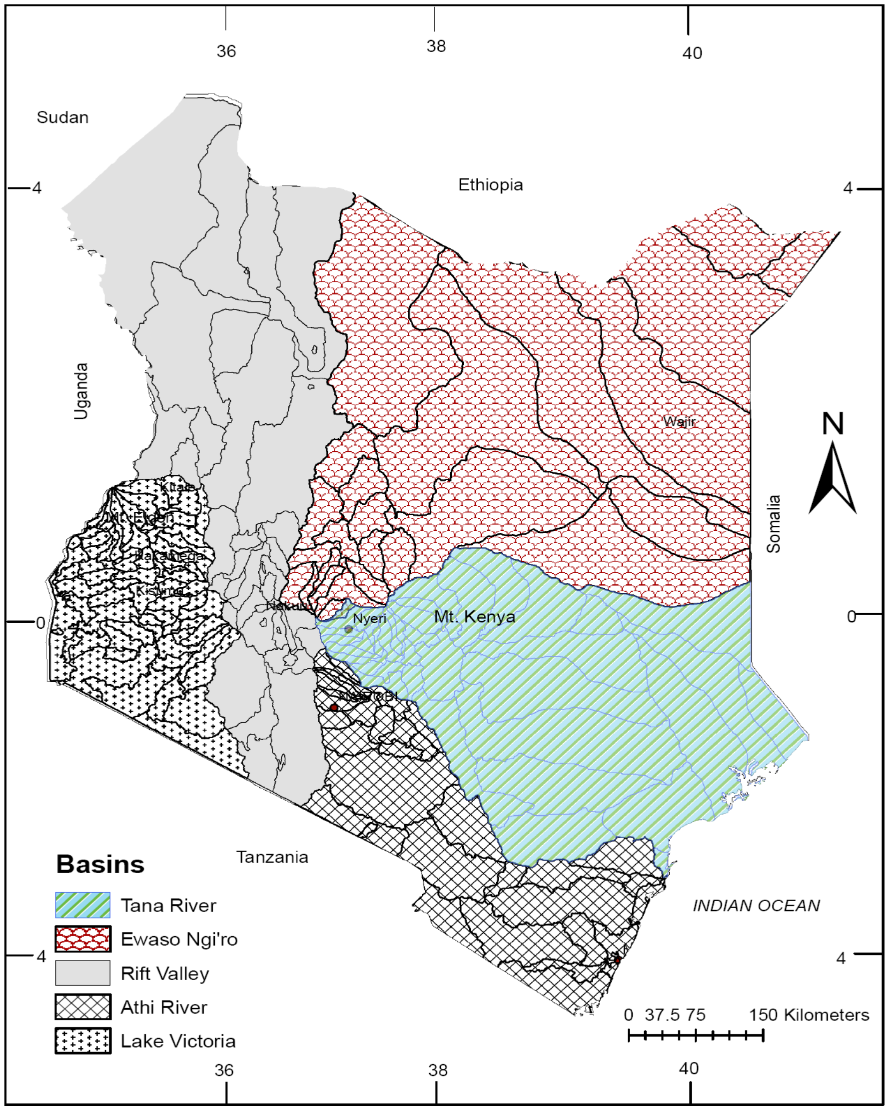


Figure 3.6: Five major River Basins in Kenya.

Table 3.3: Water potentials and abstractions from Kenya's water basins.

		Estimated annual water potential (Million m^3)			
Basin	Size in Km^2	Ground	Surface	% of national Water potential	% water Abstracted
Lake Victoria	46,000	1,157	11,672	54.1	2.2
Rift Valley	130,000	1,257	2,784	3.4	1.7

Athi River	67,000	867	1,152	4.3	11.6
Tana River	127,000	1,473	3744	32.3	15.9
Ewaso Ngiro	210,000	1,424	339	5.8	12.4

3.2.3 Population

Kenya's current population is 38.6 million (KNBS, 2010). Most of the population is concentrated in one third of the land especially in the central, southwestern, and coastal strip regions of the country. The remaining population, mostly pastoralists, occupies the northern and eastern ASAL regions of the country (Figure 3.7a). Seventy-five percent of the population is employed in the informal sector, while the remaining 25% is employed in the service sector, manufacturing, and agriculture (APPMG, 2009).

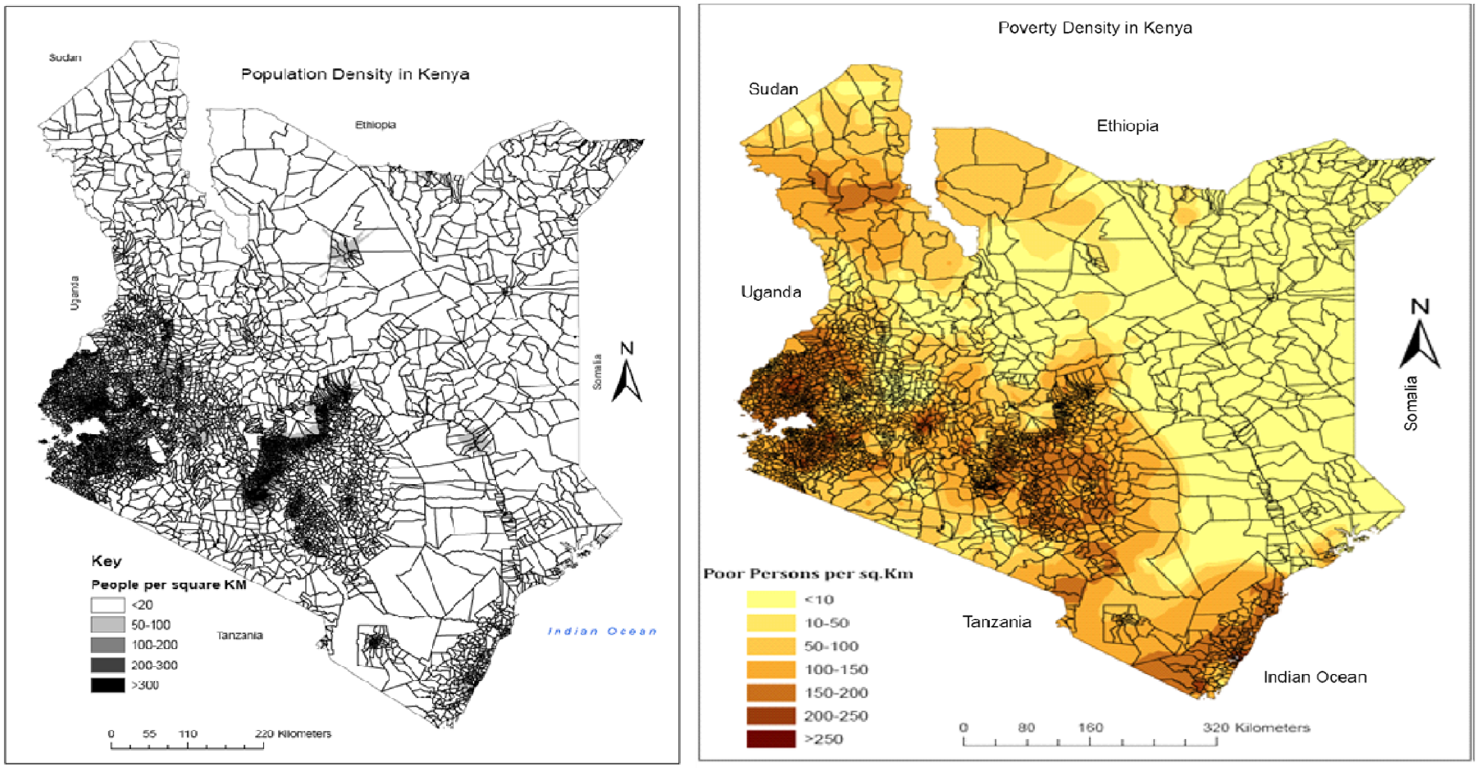
Table 3.4: Summary of Urban and rural water supplies (IEA, 2006).

WSBs	Board Area population	Urban Population served	Rural Population Served	Total population served	Total Un-served	% of Un-served population
Athi	5,617,220	2,098,313	275,527	2,374,043	3,243,177	56
Lake Victoria south	5,730,956	422,723	716,591	1,139,314	4,591,642	80
Lake Victoria North	5,135,894	589,205	350,797	940,002	4,195,892	82
Tana	5,012,208	511,078	2,217,023	2,728,101	2,284,107	46
North eastern	1,703,695	204,008	533,807	737,815	965,880	57
Rift Valley	2,999,370	344,500	206,453	550,953	2,448,417	82
Coast	2,487,264	314,593	109,951	424,544	2,062,720	82
Total	28,686,607	4,484,423	4,410,349	8,894,772	19,791,835	69

Note: Lake Victoria basin is divided into two WSBs: Lake Victoria North service Board and Lake Victoria South Service Board.

Life expectancy in the country is estimated at 53 years, having fallen from 60 years in the 1980s. The drop has been attributed to the emergence of HIV/AIDS, the impact of malaria and tuberculosis, and high poverty levels (KIPRRA, 2009). The economic outlook for Kenya (KIPRRA, 2009) estimates that 49.1% of rural and 33.7% of urban population live below the poverty line (Figure 3.7b). The poverty line is defined as those who earn less than 1560.00 Kenya shillings (US$19.50 a month) and 2950.00 Kenya shillings (US$36.60) in rural and urban areas, respectively (KIPRRA, 2009).

On the key issue of water access, the UNDP (2008) estimate the latest coverage for improved drinking water access in Kenya at about 50% (60% in urban areas and 40% rural areas), while sanitation stands at 52.3% (65% in urban areas and 40% in rural areas). Recall that according to WHO (2008), reasonable access to water means availability of at least 20 liters of water per person per day within 1 kilometer of residence. Access to improved sanitation means the percentage of the population with sufficient excreta disposal facilities such as flush toilets and pit latrines. The percentage access coverage to safe water and source of drinking water varies from region to region. Table 3.4 gives the population water access statistics for every basin in the country.



a. Kenya’s Population density (people

b. Note. The map is based on 2005 poverty line estimate of Kenya shillings 1560.00 per month in rural areas and 2930.00 in urban areas (about 19.50 dollars and 36.60

Figure 3.7: Population and poverty densities in Kenya in 2005.

3.3 Archival Research

A range of primary documents provided various types of data and information for the research project, and were used to answer objectives 1 and 2. Primary documents were of several types and were obtained from several sources, including: (1) Published government reports including policy documents. These reports were obtained from online sources, visits to government departments and officials including the Ministry of Water and Irrigation, visits to libraries, and from survey respondents. (2) Academic research articles published in a variety of international and regional journals. These were found by searching online databases covering social sciences, environmental sciences, and development studies, using key words to filter the searches. (3) Other published reports and documents produced by various institutions including Water Resource Management Authorities. (4) Unpublished government reports including those generated by advisory groups, agencies, and consultants. These were obtained from visits to government officials and from survey respondents. (5) Unpublished material generated by user groups and institutions including the Water Resource Users Association. (6) Reports from international organizations, including UNESCO, UNDP, WHO, and FAO, sourced online from the organizations' websites.

3.4 Questionnaire Survey

3.4.1 Survey Rationale

The questionnaire survey sought to obtain information that would help in the assessment of how the water sector reforms under the new law (water act of *2002)* are being implemented at the basin level. The survey identified the different agencies in the water sector (both at national and local levels), their functions, and the extent to which they are contributing to the attainment of water-related MDGs. The overriding objective was to determine how the global principles of water governance enshrined in IWRM and adopted by the government are being applied. For this purpose, personnel in water sector institutions and experts in academic institutions were surveyed for their views and opinions regarding water reform, governance, and access.

3.4.2 Development of the Questionnaire

After a thorough examination of the pertinent literature regarding water access, both generally and specifically in Kenya, a survey questionnaire with a total of eighteen closed and open-ended questions was developed (see appendix one for a copy of the questionnaire and covering letter). The questions were divided into four sections. The first section requested basic data as well as the type and number of water projects completed between 2005 and 2009. The basic data requested included water availability, total population, and population with access to water and sanitation. The second section dealt with institutions within the water sector. The section included questions that sought to identify water institutions, their functions, the extent to which they have achieved their objectives, and obstacles hindering their progress. The third section sought to gather information on legal issues at the national scale, and how these laws are put into operation at the local level. The section sought to determine the institutions responsible for initiating law, setting water standards, and regulation. The fourth section addressed stakeholder participation. The questions aimed to determine how stakeholders are included in the overall process of water provision and reforms. The questions also sought to determine the criteria against which stakeholders are selected.

3.4.3 Sample Selection

For the survey sample, consideration needed to be made of the information and data needing to be obtained, of the different types of institutions involved in water reform and water access (Table 3.5), and of the geographical distribution of institutions such as WSBs and WSPs. The aim of the sampling was to obtain a balance (e.g. Devine, 1999) of depth and fullness of information, representativeness, and diversity/variation of information reflective of the range of opinions, activities, and contexts of the various institutions and people comprising the water sector.

The goals of this study, as well as the literature regarding sampling techniques for qualitative research suggested that purposeful (or purposive) sampling would be an appropriate sampling technique (Flowerdew & Martin, 1997). For such an aim, the literature regarding sampling techniques for qualitative research indicated that purposeful (or purposive) sampling should be the technique of choice for this study (e.g., Patton 1990; Flowerdew & Martin, 1997). Purposive sampling is targeted at a small group of people, carefully selected based on their knowledge and interest in the subject under study (Flowerdew & Martin, 1997). This method was chosen because the goal was to conduct a contextual examination of a specific phenomenon (Yin, 1994). Initial participants were identified through purposive criterion sampling (Patton, 1990), where stakeholders in the water sector (comprising civic, government, NGOs, and learning institutions) were identified and contacted. Subsequent participants were identified through snowballing and opportunistic methods where previous participants helped identify other potential participants and other leads were discovered during the process of survey fieldwork (Flowerdew & Martin, 1997); Patton, 1990). This was useful as it allowed networks of people to uncover possible respondent groups who otherwise may not have been readily identified, for example, some of the Water Resource Users Associations.

3.4.4 Questionnaire Testing and Survey Administration

After preparing the questionnaire, approval was sought from University of Oklahoma's Institutional Review Board (IRB). The study was approved on 8/28/2009, and was exempted from the IRB review process because it posed no danger to human subjects and had minimum to no privacy violation. Analysis of the results did not require the use of participants' names or identifiers, other than data concerning how many questionnaires were returned from each participating institution.

Before the questionnaires were sent out, a pilot program was conducted in September of 2009 via email. In the pilot program, a questionnaire was sent to each of ten selected employees of Lake Victoria North Service Board. This helped to establish the appropriateness and clarity of the questions, as well as the time needed to answer the questions. The pilot program also aimed to indicate whether the data and information that were being sought would be available.

After adjusting the questions based on the response to the pilot program, 144 questionnaires were sent via email to different individuals in different institutions on 9/15/2009 (Table 3.5). A cover letter briefly describing the purpose of the questionnaire and the research project, and the contact details of the researcher, headed the questionnaire. After one week, 30 individuals had responded to the questions. At that point, a follow-up email was sent to those who had not yet responded, resulting in an additional 20 responses. In addition, interviews were scheduled where the questionnaire was distributed to a further 30 people between 12/24/2009 and 1/11/2010, which represented the end of survey data collection.

Many respondents, especially those from the MWI, Water Resource Authority, WASREB, WSPs, and WSBs, chose to attach information containing requested data with their returns. These included institution reports, internal memos, and policy documents. The breakdown of the survey participants with respect to their institutions, and questionnaire response rates, are presented in Table 3.5. The questionnaire results were analyzed, with information being summarized in tables, figures, and textual modes in chapters four and five

Table 3.5: Details of survey sample

Institution	Questionnaires sent/received		
	Questionnaires sent	Questionnaires received	Response rate (%)
Ministry of Water and Irrigation (MWI)	15	10	67
Moi University and Nairobi University	5	5	100
Water Resource Management Authority	4	4	100
Water Services Regulatory Board (WASREB)	10	6	60
Water Service Trust Fund	5	4	80
Water Service Providers (WSPs)	35	15	43
Water Service Boards (WSB)	20	16	80
Water Resource Users Associations (WRUAs)	50	20	40
Total	144	80	55

3.5 Data Envelopment Analysis

Data envelopment analysis (DEA) was used to assess the water provision efficiency of WSPs. This section describes performance analysis, outlines the various methods that can be used to measure productivity and efficiency, and finishes with a detailed account of DEA, the chosen method. Measuring efficiency is intended to determine whether the water service providers are on track to achieve the MDGs. Government's failures (especially in Africa) to meet the target of universal access by 1990 was widely blamed on inefficiencies by the water providers.

3.5.1 Performance Analysis: A theoretical Framework

Performance is measured in terms of efficiency and productivity. Efficiency is the extent to which the resources (inputs) of a company are utilized optimally to produce the required service (outputs), and is always expressed as a ratio of outputs to inputs yielding a score between 0 and 1, with best-performing firms receiving a score closer to 1 (Alegre, 2004). As an example, Table 3.6 provides an example of such an analysis, with estimates of the efficiency of five firms based on the number of employees (inputs), and the percentage of population with access to water (outputs). Efficiency levels listed in the last columns of the table show that Garissa is the most technically efficient firm, operating at 0.95 (95%) of its potential, while Kahuti is the least, operating at 0.28 (28%) of its potential. The reason for measuring efficiency is to determine whether a firm could have secured more output (technical output efficiency) for its input levels or could have used fewer inputs for its output levels (technical input efficiency) (Thanassoulis, 2000). There are different types of efficiency score measurements (e.g. operational efficiency, management efficiency), but unless a company is technically efficient, it is not possible for it to be efficient in other areas.

Table 3.6: Performance of five water providers in Kenya

	Firms	Employe (input-x)	% Population coverage (Output-y)	Efficiency (Y/X)=TE	CRSTE
A	Kahuti	43	12	0.28	0.29
B	Amatisi	58	22	0.38	0.40
C	Nyeri	111	57	0.51	0.54
D	Muranga	63	52	0.83	0.87
E	Garisa	60	56	0.95	1.00

TE = technical efficiency; CRSTE = constant return to scale technical efficiency.

The Technical Efficiency (TE) of a firm is defined by production frontiers (for example ray, OF in Figure 3.8) which represent the maximum output attainable from each level of input for the current level of technology within a firm. A firm will operate on that frontier if it is technically efficient (for example firms A and B), or below the frontier line if they are inefficient (for example, firm C). Firm C is technically inefficient because it could increase its outputs to the same level as firm B without increasing its inputs, or it could produce at the same outputs and produce at the level of firm B by reducing its input. The distance CB represents output slack values which indicate spare capacity, while CA represents input slack values which indicate wasted resources (Coeli, et al. 2003).

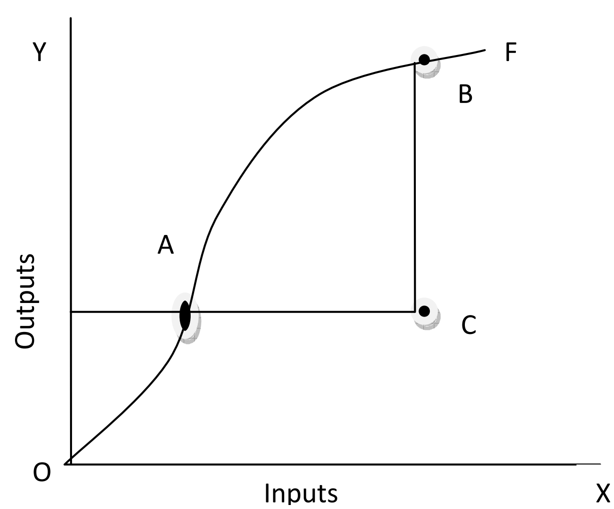


Figure 3.8: Production frontiers and technical efficiency.

Productivity, on the other hand defines, a point along the production frontier where a firm can achieve the maximum possible production. If firm C in Figure 3.9

moves to a productive level similar to firm B, it will be efficient, but it would produce at an optimum level only if it were to move to the production level of firm A where the ray OG makes a tangent with the production frontier. This level determines a position where the firm exploits economies of scale meaning that firms can change their efficiency levels by changing their scale of operation. Firms A and B are therefore efficient in terms of TE but firm A is the only firm operating at an optimal level, and is therefore the most productive firm. In order to achieve Scale Efficiency (SE), firms B and C must move to production frontier line OG, commonly known as Constant Returns to Scale (CRS), as oposed to line OF which represent Variable Returns to Scale (VRS). Under the CRS assumption, when inputs are scaled up or down, the outputs are scaled by the same factor. The advantage of using CRS for analysis is that it allows firms of different sizes to be compared and benchmarked. The VRS assumption considers the scale of operation of a firm and will only allow firms of the same sizes (similar mix of inputs and outputs) to be compared against each other. The distance between each data point and CRS is refered to as Constant Return to Scale Technical Efficiency (CRSTE) , and defines the overall productivity of a firm and contains both TE and SE (CRSTE= TE x SE). CRSTE can also be achieved by dividing each TE by the largest TE as shown in the last column of Table 3.6. CRSTE defines the overall productivity of the firm.

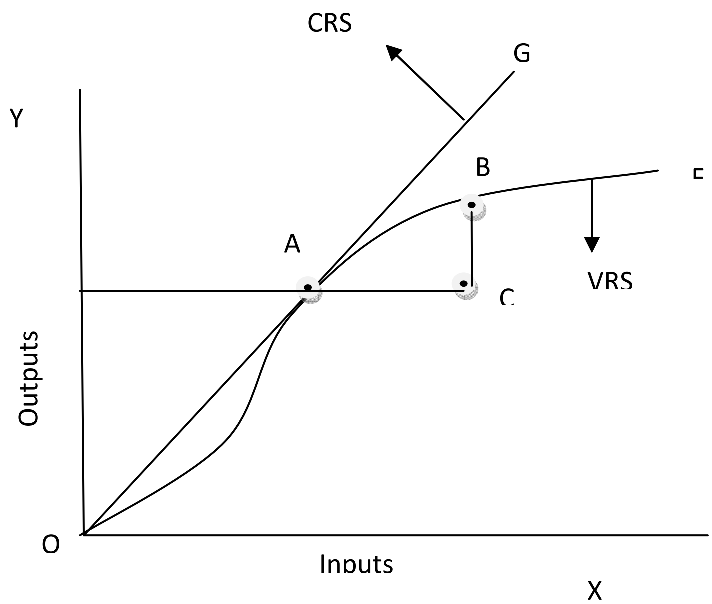


Figure 3.9: Efficiency under TE (technical efficiency) and SE (scale efficiency).

The foregoing discussion has centered on simplified partial factor productivity, where a firm deals with one input and one output, and is therefore not very feasible in real life situations where firms deal with multiple inputs and outputs (including environmental factors) that may influence the production process. Efficiencies in this case can be measured using several methods, as described below.

3.5.2 Productivity and Efficiency Measurement Methods

Efficiency methods can be classified as average or frontier-oriented (Giannakis, Jamasb, & Pollitt, 2005). Average methods include performance Indicators and parametric methods, while frontier methods include non-parametric methods.

3.5.2.1 Performance Indicators (PIs)

A performance indicator is simply a ratio of output to input of a firm being assessed. A PI measures the level of actual performance achieved in a certain area of activity during a given period of time compared to established benchmarks (Coelli & Shannon 2006), and allows ranking of companies based on performance in one or more PIs, including aggregate indicators. When aggregated indices are measured in different scales (for example, % of water coverage, water used per year in cubic meters, revenue collected), they must be transformed into comparable units to allow for overall comparison of companies. The indices are transformed using different procedures including benefit (Equation 3.1) and cost (Equation 3.2) procedures (Malczewski, 1999):

$$PI = \frac{actualPI}{MaximumPI} \times 100 \qquad 3.1$$

Where PI is the standardized score, ranging from 0-100, with higher values signifying higher productivity. In cases where lower scores are desirable (e.g., % water loses), the cost standardization procedure may be used:

$$PI = 1 - \frac{actualPI}{MaximumPI} \times 100 \qquad 3.2$$

After calculating the individual indicators, the final index of a company is obtained by summing up the weighted average of the entire PI. This allows a comparison to be made of each company with the best and worst performing companies.

Many agencies in the water industry have developed and tested several indicators that can be used in their industry. The International Water Association (IWA), for example, has developed a system of PIs that is considered a standard reference in the industry (Alegre, 2004). The IWA system groups PIs into six main categories of performance depending on their similarities: (1) water resource indicators, (2) Personnel indicators, (3) Physical indicators (4) Operational indicators, (5) Quality of service indicators, and (6) Financial indicators. Each sub-category can be divided further into several categories (an example of operational indicators is shown in Table 3.7). Other PI systems include The World Bank Benchmarking Toolkit (http://www.worldbank.org/html/fpd/water/topics/uom_bench.html), the Asian development Bank Data book (McIntosh & Iniguez 1997), and the Water Utility Partnership for Capacity Building in Africa (www.uade-wup.org).

Table 3.7: International Water Association operational indicators

	Indicator	Description	Level (L)
1	Water Loses	m^3 /connection/Year	L1
2	Service connection failures	No/1000connection/year	L1

3	Power failures	Hours/pumping station/year	L2
4	Service rehabilitations	% /year	L1
5	Water quality tests	%/year	L1
6	Meter reading efficiency	%/year	L1
7	Meter calibration	% /year	L3

Many utility companies, including WASREB in Kenya, use a PI system for efficiency analysis, because of its simplicity in calculation and interpretation. The main problem with PIs is that they do not capture how multiple inputs and multiple outputs interact in the transformation process (Coelli & shannon, 2006). Zhu (2009), for example, notes that PIs may be used as indicies to characterize the performance of a firm, but they are unsatisfactory in determining best practice. A more realistic analysis that involves multiple inputs and outputs requires the use of parametric and non-parametric methods.

3.5.2.2 Parametric Methods

Parametric methods of performance analysis are statistical methods that estimate efficiencies by constructing production frontiers derived from the averages of all firms being assed. For example in equation 3.3 (Thanassoulis , 2001), ordinary least squares regression (OLS) can be used on observed input-output correspondences for the firm being evaluated. The efficiency of a firm is determined by a fraction of predicted level of $f(\beta, y1, y2, \ldots ys)$ to observed input level x where the larger the ratio, the more efficient the firm.

$$\boldsymbol{x} = \boldsymbol{f}(\boldsymbol{\beta}, \boldsymbol{y1}, \boldsymbol{y2}, \dots \boldsymbol{ys}) + \boldsymbol{n} \qquad 3.3$$

Where $\boldsymbol{x}$ = Inputs

$y1, y2, \dots . ys$ = outputs,

β = a set of unknown parameters to be estimated, and

n =represents random noise.

The main problem with the regression model, however, is that it estimates efficiencies based on averages and does not explicitly provide an allowance for inefficiencies, which is a critical component of company performance, especially in the water sector (Thanassoulis, 2000). For this reason, stochastic frontier analysis (SFA) is frequently used to solve the problem. The SFA measures involve the use of parametric techniques (e.g., equation 3.4) to estimate efficiency by first constructing production frontiers derived from the firms being assessed, then comparing the actual output of the firms to the optimum level they could achieve (Thanassoulis, 2001):

$$\mathbf{x} = \mathbf{f}(\boldsymbol{\beta}, \mathbf{y1}, \mathbf{y2}, \dots . \mathbf{ys}) + \mathbf{v} + \mathbf{u} \qquad \mathbf{3}.4$$

Equation 3.4 explicitly accounts for inefficiency by decomposing the random error *n* in equation 3.3 into two terms: the random term *v* (normally distributed) and the term *u* (u ≥0), which reflect inefficiency. The unknown parameter β can be estimated by regression methods, after which efficiency is determined as the expected value of *u* given the value of *v+u.*

3.5.2.3 Data Envelopment Analysis (DEA)

DEA was promoted by Charnes, Cooper, and Rhodes (1978), as an extension of linear programming production economics and efficiency measures initiated earlier by Farrell (1957). DEA is a non-parametric method of measuring efficiency of similar firms, which use similar inputs to produce similar outputs in varying quantities (Thanassoulis , 2000). In DEA terminology, the resources used for production are referred to as "inputs", while the outcomes are the "outputs". The firm transforming the inputs into outputs is referred as to as Decision Making Unit (DMU) (Figure 3.10).

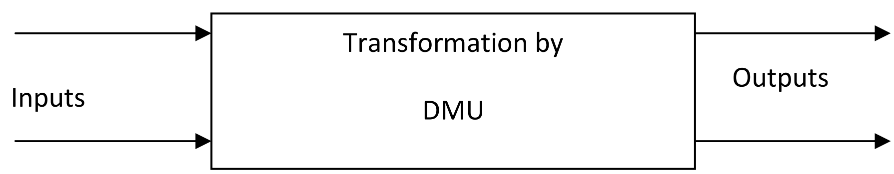


Figure 3.10: A DMU transforming inputs into outputs

The rationale for DEA is to assess how efficient a particular DMU is in transforming the inputs into outputs compared to other DMUs. Measures of efficiency are based on the degree to which a DMU can maximize its outputs without increasing the inputs (output oriented) or the degree to which it can minimize its inputs without decreasing the outputs (input oriented). In other words, DEA determines the potential for input reduction for a given DMU, given its current output levels or alternatively potential for output increase with the current levels of inputs (Thanassoulis, 2000).

The DEA model is based on the following assumptions: (1) The Production Possibility Set (PPS) defines all input and output correspondences which are possible in a production process, including those which have been observed (for example Figure 3.11); (2) Interpolation between feasible output and input correspondences leads to input-output correspondences feasible in principle; (3) Inefficient production is possible; (4) No output is possible unless some input is used; and (5) The relationship of input-output variables should conform to the principle of exclusivity and exhaustiveness, which means that, subject to environmental or contextual factors involved, the inputs alone should influence the output levels being assessed (Thanassoulis, 2001).

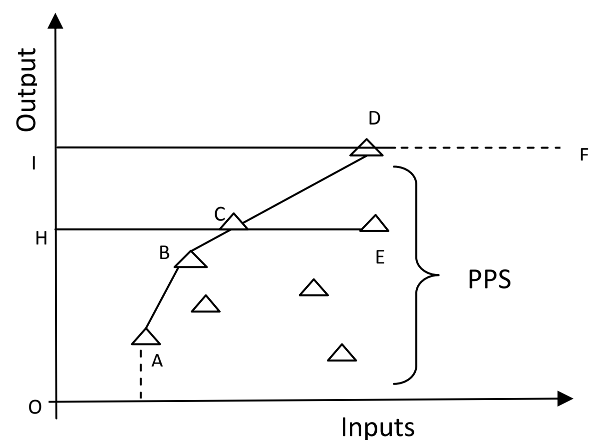


Figure 3.11: Graphical assessment of DEA.

In Figure 3.11, the PPS is represented by all input-output correspondences on the production frontier line ABCD, which "envelops" all the actual correspondences and virtual projected correspondences below and to the right of the frontier function. To estimate the efficiency of DMU E, for example, it is apparent it could reduce its inputs and produce the same amount of outputs by moving to DMU C. The efficiency will therefore be HC/HE, which reflects the ratio at which DMU E could lower inputs by using

C as a benchmark peer to emulate. Alternatively, DMU E could produce more outputs with the same mix of inputs by moving to D., where it would increase its outputs by a ratio of OH/OI.

Figure 3.11 uses a single input-output transformation to illustrate the theory behind DEA. However, in practice, most DMUs involve the transformation of a multiple output-input process which requires a complex methodology to handle all possible input-output interactions. In this case, linear programming (LP) is used for analysis. LP is a branch of mathematical analysis dealing with methods for optimizing (minimizing or maximizing) an objective function of *n* variables subject to a specified constraints on the variables (e.g. in equation 3.5) (Katta, 1983) in order to find the best (optimal) solution. The procedure starts by constructing a PPS, which reflects the decision being considered. The model then defines mathematically all the possible solutions and contains mathematical expressions which seek to optimize the results.

3.5.2.4 Specification of DEA model for efficiency analysis of Water Service Providers (WSPs)

The DEA model was chosen because it measures the efficiency of each DMU with respect to the production frontier estimated from a combination of all the firms without *a priori* underlying functional form (for example, linear, non-linear, or logarithmic functional form) as well as distribution form assumptions (for example, normal or bimodal distribution) (Anwandter & Ozuna, 2002). This protects the model from errors associated with miss-specified functional and distributional forms. The model is also capable of accommodating multiple input-output correspondences, including their interactions and tradeoffs (Coeli, et al. 2003), and has the ability of producing information on peer firms for each of the inefficient firms (Coelli & shannon, 2006). In this study, the DEA model was used for the following analysis steps (Thanassoulis, 2001):

1. Compute the measure of the efficiency of each DMU and ascertain the robustness of the efficiency scores;
2. Identify the areas of good practice which could be emulated by poorly performing DMUs
3. Obtain a view on the frequency of a DMU acting as a peer (role model) for other DMUs; and
4. Estimate the target input-output levels which every DMU, based on available resources, can attain.

The model, however, does have some disadvantages. It is deterministic rather than stochastic in nature and therefore produces results that are sensitive to measurement errors. Poor data quality can therefore distort the shape of the frontier, thus giving a misleading picture of efficiencies or inefficiencies. In regression-based models, this problem is solved by specifying error terms (*n* in equation 3.3). To mitigate this problem, the input-output variables were selected through a sensitivity analysis and also expert knowledge from WASREB from whom data was acquired. Sensitivity analyses were performed by running assessments with and without variables that were deemed to have secondary role in the results. Variables without significant impact were dropped from the analysis.

The model is also sensitive to sample size. Increasing the sample size tends to reduce the efficiency score, while using very few DMUs relative to the number of inputs-outputs tends to inflate efficiencies (Steering Committee for the Review of Commonwealth/State Service Provision, 1997). The rule of thumb in DEA is that the number of DMUs in a sample should be three times higher than the sum total of input-output used for analysis (Nunamaker 1985). The relationship of input-output variables should further conform to the principle of exclusivity and exhaustiveness, which means that, subject to exogenous factors involved, the inputs alone should influence the output levels being assessed (Thanassoulis, 2001). Exogenous (contextual or environmental) factors that may impact the results should be reflected in the analysis. In order to capture these factors, a two-stage analysis process is often used. In the first stage, a DEA assessment is undertaken with non-contextual input-output variables, and in the second stage a regression of DEA efficiency scores is performed against environmental factors to identify those that affect the efficiency, and to adjust the model.

Initial input-output variables were selected through a combination of sensitivity analysis and experience from the industry, with variables without significant impact being dropped and resulting in a final set as reported in Table 3.8. The study uses two input variables (number of employees and salaries) as a proxy for capital and one variable (UFW) as a proxy for losses. Four output variables (water coverage, number of water connections, hours of water supply, and collection efficiency) were used to measure the quality of service (Table 3.8). These output variables are commonly used by network industries such as those involved in the supply of electricity, water, and gas to ensure that similar firms (in terms of customer size and network density) are compared and benchmarked against each other (Coelli & shannon, 2006). It is recommended that input-output variables should be few as possible in order to maintain a high level of discriminative power of efficiencies on DMUs being assessed. This is because the larger the number of input-output variables relative to the number of DMUs, the less discriminating is the assessment (Thanassoulis, 2001).

Table 3.8: Input and output variables for the Data Envelopment Analysis performed on Water Service Providers in the study.

Inputs (to be minimized)	**Outputs (to be maximized)**
Staff (number of employees)	Water coverage (% population covered)
Salaries (gross monthly in(KSH)	Number of connections
UFW	Hours of water supply
	Metering ratio
	Collection efficiency

The following DEA model (equation 3.5) is input-oriented where the inputs are minimized and outputs are kept at the current levels (Charnes, Cooper, & Rhodes, 1978). The input oriented model was chosen because managers of WSPs have the power to manipulate their inputs and less power to control their output (Kirkpatrick, Parker, & Zhang, 2006).

$\theta^* = min\theta$

Subject to

$$\sum_{j=1}^{n} \lambda_j \, x_{ij} \; \leq \; \theta x_{io} \quad i = 1,2, \ldots \ldots m$$

$$\sum_{j=1}^{n} \lambda_j \; y_{rj} \; \geq y_{ro} \quad r = 1, 2, \ldots \ldots s \qquad 3.5$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda \geq 0$$

Where θ^*, is a scalar measure of TE, (which takes a value between 0-ineffcient and 1-efficient).

λ non-negative scalar such that $\sum_{j=1}^{n} \lambda_j = 1$

$\sum_{j=1}^{n} \lambda_j \, x_{ij}$ (i=1, 2, .m) possible inputs of a DMU

$\sum_{j=1}^{n} \lambda_j \; y_{rj}$ (i=1, 2, .s) Possible outputs of a DMU

y_{ro} and x_{io} are the r-th output and i-th input for a DMU respectively.

3.6 Conclusion

The research in this study uses mixed methods to obtain and analyze data and information on water reforms in Kenya. The methods include: (1) Archival research of documents obtained from academic literature databases, government agencies, water sector institutions, and development agencies; (2) A questionnaire survey of individuals working in, or associated with, the water sector, including government departments, water service boards, water user associations, and universities; and (3) Quantitative analysis (data envelopment analysis, or DEA) of water provision statistics using Water

Service Providers (WSPs) as the unit of interest. Kenya was chosen as a case study because it provides an excellent example of a historical water reforms and a new water reform policy whose theoretical content and practical implementation can shed light on the challenges and opportunities for improving water access in among developing countries.

Chapter Four: History of Water Sector Reforms in Kenya and the Implications for Water Access

4.1 Introduction

Over the past few decades, Kenya has undertaken major institutional and policy reforms in the water sector. The most notable and widespread of these reforms was initiated in the year 2000. Through the *National Poverty Eradication Plan* (NPEP, 1999-2015) and the endorsements of the MDGs (UN 2000), the government committed itself to “assure water supply, sewerage services and basic sanitation for all Kenyans for improved health and wealth creation on an individual level and for the nation” (MWI, 2007, p.13). This goal would be achieved in two phases: (1) to reduce by 50% the percentage of population without access to water by the year 2015 (and thereby achieve the MDG); and (2) to assure access by all people by the year 2030. At the time of this declaration, only 16 million (51%) of the total population of 31 million had access to safe drinking water. As the country struggles to achieve this goal, the most daunting task is to provide access to safe and adequate water supply for domestic, agriculture, and industrial purposes in face of water scarcity facing most of the country.

As mentioned in section 1.3.1, Kenya has a total renewable water supply of 647m^3 per year per capita, which qualifies it as chronically water scarce country based on the Falkenmark Index (Falkenmark M. , 1989). Faced with this reality, the government in 1999 adopted a new National Water Policy (The National Policy on Water

Resources Management and Development). Following the adoption of this policy, the Ministry of Water and Irrigation formulated two strategic plans, one to serve as a blueprint for water service and sewerage provision (The National Water Service Strategy - NWSS), and the other for management of water resources (National Water Resource Management Strategy - NWRMS) (MOWI, 2008). The NWSS seeks to increase water access from 60% to 72% in urban areas and from 40% to 59% in rural areas. The NWRMS seeks to increase regular monitoring of water resources to 70% and implement Sub-catchment Management Plans (SCMP) in each basin (WSTF, 2010). Prior to these reforms, the legal policy framework in force was the *Water Act 372*, which vested the task of providing water and sanitation services mainly in the hands of the government. The reforms replaced the old legal framework with the *Water Act of 2002* (GoK, 2000), whose main tenets are the decentralization of water management ,service provision, and the participation in the management and provision of water services by non-governmental organizations, private entities, community groups, and other stakeholders.

This chapter reviews institutional reforms that have taken place during the pre-colonial period (before 1895), the colonial period (1895 to 1963), and the post-independence period (1963 to 1999). These periods set a context for historical water sector reforms and the outcome of those experiments. With such a background, the chapter then evaluates the institutional reforms that have taken place since the declaration of the Millennium Development Goals (MDGs) in 2000. This review focuses on reforms in three main institutional elements: (1) national water policies; (2) the legal framework; and (3) institutional arrangements at both the national and water basin scales. The functions of different institutions as well as their progress and challenges regarding MDGs target will be discussed.

The chapter presents results based on archival research (see Section 3.3) and the responses to the questionnaire survey (see Section 3.4) of water sector institutions and interest groups. Section 4.2.1 presents a historical review of water reforms in Kenya from the colonial period to the year 1999, alongside the implication of these reforms to water access in the country. Section 4.2.2 analyzes water sector reforms started in the year 2000 and how the water institutions are presently structured from the national level to the basin level. The next sections (4.2.3-4.2.5) examine the different institutions created during the 2000 reforms, their functions, their status in terms of achieving their objectives, as well as the obstacles encountered by the institutions. Section 4.2.3 examines water management by looking at the Water Resource Management Authority (WRMA). On the water supply side, section 4.24 discusses the Water Services Regulatory Board (WASREB), including the roles of Water Service Boards (WSBs) and Water Service Providers (WSPs). Section 4.25 examines the Water Services Trust Fund (WSTF) and how it is faring regarding water project funding. Section 4.3 discusses how stakeholders have been included in the whole reform process.

4.2 Institutional Reforms

Water institutions refer to formal and informal sets of policies, laws, and procedures which describe and determine procedures for managing water resources and provide a framework to guide economic outcomes, as well as the organizations and management units created by such policies (Nemarundwe & Kozanayi, 2003). Institutional reforms emerge as a response to both endogenous and exogenous factors (Saleth & Dinar, 2005). Endogenous factors are internal to the water sector, and include water scarcity, water conflicts, infrastructural investments in the water sector, and governance. Exogenous factors are external to the water sector, and include international commitments, demographic changes, global economic crises, climate change, and political and cultural changes. To understand the reforms that have taken place in the Kenyan water sector, their challenges, and successes, it is necessary to review the historical evolution of the institutional framework governing the water sector in four periods: (a) the pre-colonial period (before 1895); (b) the colonial period (1895-1963); (c) the post-independence period (1963-1999); and (d) the post-millennium period (after 2000). A review of historical reforms over these periods is required in order to understand any path dependency of the reforms that may exist (Ostrom, 2000). Path dependency explains how the present institutional arrangement may have been influenced by previous institutional set-ups.

4.2.1 Institutional arrangements: pre-colonial to post-independence

4.2.1.1 Pre-colonial period (before 1895)

During the pre-colonial period, the management of natural resources, including water, lay in the hands of local institutions that determined rules for water management as well as the allocation of the resource. These institutions were embedded within a cultural framework and varied from one region to another (Nilsson & Nyanchaga, 2009). In Kenya for example, there are more than 43 indigenous groups, and, with such cultural plurality, came diverse institutional arrangements for governing water (Nilsson & Nyanchaga, 2009). Huggins (2000) and Meinzen-Dick & Nkonya (2005) have identified the following tenets as common to these institutions: (1) Water was regarded as a communal property, and no person could be denied water for domestic purposes, including drinking; (2) Some water rights could be acquired by individuals or groups, and the chances of acquiring such rights increased with input of labor and capital; (3) Rights were not fixed, but negotiable, in order to adapt to changing circumstances like droughts; and (4) The control and determination of water rights was vested mainly in the councils of elders and was closely linked to rights over land.

Regardless of the specific structures adopted, the point is that indigenous communities in Kenya had established institutions to manage water long before the colonial era. The Turkana and the Marakwet peoples in the dry areas of the Rift Valley, for example, cultivated sorghum and other crops in the floodplains of River Kerio and Turkwell. They used a sophisticated furrow system to transfer water over several kilometers to irrigate lands and water their animals as part of a subsistence pastoral strategy (Adams & Anderson, 1988; Watson, Adams, & Mutiso, 1998). Within these communities, water rights were linked to land rights and other groups could only gain access by buying the rights. Water allocation during the irrigation season depended on communities' participation in canal maintenance and was determined at a meeting attended by different villages. Each village would then have a separate meeting to allocate water to its different clans, who would further divide it to different individuals depending on their lineage (Watson, Adams, & Mutiso, 1998). Similar methods were used by the Pokomo along Tana River (Fleuret, 1985), and the Chamus of Lake Baringo (Adams & Anderson, 1988).

The migratory patterns of the Maasai people called for water use agreements along migratory routes negotiated with other clans and sometimes among other tribal groups (Huggins, 2000). The Maasai community formed political, social, and cultural institutions that allowed it to make a living in a water-scarce environment. The nomadic tribes of northeastern Kenya (e.g., the Somali and Borana) were in constant movement in search of water and pasture. Along their migratory routes, they dug ground water wells at regular intervals to provide water for their caravans (Cech, 2010).

4.2.1.2 Colonial period (1895-1963)

The advent of colonial power in the late nineteenth century imposed new socio-political structures on the water sector, thus changing the dynamics of water management in the country. During colonial times, the British imposed a dual system of governance based on land rights (Nilsson & Nyanchaga, 2008). The “Crown Lands” alienated from the Africans were governed by statutory laws introduced from Britain while the “Native Lands” set aside for the Africans continued being governed by customary laws. The native lands were mostly dry and in some cases too swampy and in need of draining to support agriculture.

The first attempt to legislate management of water in Kenya was made through section 3 of *the Crown Land Ordinance of 1902* which gave authority to the Queen of England to alienate land and natural resources from the local people (Onyango, Swallow, & Roy, 2007). Section 75 of *Crown Land Ordinance* denied any person express right to spring, river, lake, or stream water except for domestic purposes, while section 145 prohibited the damming of a spring or a river without express permission of the colonial government (Nyanchaga & Ombogi, 2007).

Key to colonial economic ambition was finding a quick means of transportation to improve communication between the Kenyan coast and the mainland, for the purpose of evacuating cash crops and natural resources to Britain (Nilsson & Nyanchaga, 2008). As a consequence, construction of the Uganda railway in the 1900s played a major role in establishing small towns along the railway. These cities tended to be planned by the colonial activities and usually provided with piped water. They would subsequently evolve into the current major towns of Nairobi, Nakuru, Eldoret, Kisumu, and Kitale (Nilsson & Nyanchaga, 2008; Nyanchaga & Ombogi, 2007). Water supply development during this period was performed by the Hydraulic Branch of the Public Works Department, which had its offices in the coastal city of Mombasa and later expanded to the capital Nairobi and Kisumu in 1902 and 1903, respectively. The Hydraulic Branch later extended water services to other emerging urban areas.

Subsequently, the *Water Ordinance No. 35* of 1929 was enacted for "employment and conservation of waters and for the regulation of water supply, irrigation, and drainage" (Branigan et al., 1932 p. 154). The Act also established the ownership of all natural water bodies in the Crown, vesting the right of control in the Governor. A Water Board was created and given the authority to manage water, enforce the law, and grant water rights through permits. The policy gave the colonial government full control over the water supply of the country in order to satisfy the imperial quest for agricultural expansion in the White Highlands (Nilsson & Nyanchaga, 2008; Grigg, 1932). The ordinance was passed after a program of research by the colonial government on agriculture, soil, and livestock, with the aim of exploring the suitability of the environment for growing and raising exotic crops and animals, especially wheat and hybrid cattle for export to the western world (Grigg, 1932). This initiative was blamed for enormous environmental problems such as soil erosion and deforestation during colonial period (Ward, 1932), as well persistent famine problems experienced to date. Kenya still maintains the colonial traditions of wheat, tea and coffee plantations at the expense of traditional crops like sorghum. This practice for example has created not only water shortages because of high water footprint required by these crops but also overall food shortages (Shiva, 2000).

The Crown Ordinance further gave mandate to the department of public works to drill wells to increase the supply of water in the Crown lands (Grigg, 1932). However, because of the Second World War, the country sunk into depression and only very limited development took place in the water sector until 1952, when the water *ordinance of 1929* was re-enacted, to allow the creation of two agencies: a Water Resources Authority and a Water Apportionment Board. The Water Resource Authority was in charge of policy and development planning, while Water Apportionment Board was in charge of water allocation. This institutional arrangement remained in force until 1972 when it was replaced by the *Water Act Cap 372* of Laws of Kenya.

4.2.1.3 Post-independence period (1963-1999)

The post-independence government of Kenya put in place different targets and strategies for economic development and poverty eradication. The session paper No. 10 of 1965 on *African Socialism and its application to planning in Kenya* (GoK 1965) directed government efforts towards the provision of free or subsidized services, including water (Nyanchaga & Ombogi, 2007). In 1972, the colonial ordinance of 1952 was replaced by Cap 372 of Laws of Kenya. The Law retained both of the two colonial agencies (Water Resource Authority and Water Apportionment Board), but decentralized their activities by creating catchment based water boards and catchment committees (Nilsson & Nyanchaga, 2008).

In 1974, the government enacted the first National Water Master Plan, with a goal of ensuring access to potable water at a reasonable distance to all Kenyans by 2000 (GoK, 2002). The target would be achieved by constructing water supply projects financed mainly by the government. The first structural change towards this goal in 1974 was to upgrade the Department of Water Development (DWD), which was housed in various ministries such as the Ministry of Agriculture, Ministry of Public Works, and Ministry of Natural Resources, to a full Ministry of Water Development (Mumma, 2007). The new government ministry embarked on an ambitious program of water supply in the 1970s to 1990s. These projects included the National Irrigation Board (NIB) and the National Water Conservation and Pipeline Cooperation (NWCPC). The NIB created under the Irrigation Act, Chapter 347 of 1967, was vested with the responsibility of the administration of irrigation schemes including the supply of water to the residents within the irrigation schemes. The NWCPC was created to operate government owned water supply systems, especially in rural areas, leaving large municipalities to supply water within their jurisdictions (Mumma, 2007). The change in policy was meant to enhance social equity, which had been severely neglected during the colonial period (e.g., differential water allowances for African locals and colonialists, respectively), while at the same time injecting cost recovery principles into the water delivery system.

The progress in improving water access was, however, hampered by budget constraints, forcing the government to shift its priority from constructing new infrastructure to rehabilitating existing projects, and to partially privatize its services (IEA, 2006,). The problems were triggered by the early 1980s debt crisis, which affected many countries in Africa, and by the subsequent requirements of the IMF and World Bank that these countries control their debt to GDP ratios. The Structural Adjustment Programs (SAPs) recommended by these institutions required governments to reduce spending in public sectors, including the water sector, as a condition for future funding. In 1997, the government began the process of transferring rural water supply systems into the hands of the communities, who were to act as custodians of the schemes and take over operation and management costs of the systems (Mumma, 2007). By 2000, the target of ensuring satisfactory water availability for everybody, as previously spelled out in the National Water Master Plan of 1974, had not been reached. With a population standing at 31 million in 2000, only half the population had access to potable water (Table 4.1), and only two-thirds of the urban population had access to reliable potable water supplies (GoK, 2001).

Table 4.1: Water service projects and access in Kenya by 2000

Water Service Provider	Water service projects	Population served by 2000 (millions)
NWCPC	21 Urban water supply systems	2.3
	14 Rural Water Supply systems	1.5
DWD	73 Urban water supply systems	1.4
	555 Rural water supply systems	4.7
Municipalities	10 Urban municipalities	3.9
Community groups	----	2.3
Total		16.1

4.2.2 Institutional Reforms after 2000

After missing the target of universal access to water supply by the year 2000, the Kenyan Government ordered a review of the water sector management and institutional framework with a view to identifying the shortcomings. With the *Sessional Paper No 1 of 1999 on National Policy on Water Resources Management and Development* (GoK, 2000), the government recommended changes in water policy, regulation, and service provisions to address the problems apparent in the system, as summarized in Figure 4.1. The policy change was implemented by enacting a new institutional framework law *(Water Act of 2002)* to replace the old Water Act Chapter 372. Through the *Water Act of 2002*, the government recognized that achievement of the MDGs required fundamental changes in the water sector in order to increase coverage, reduce unaccounted for water (UFW), improve governance and transparency, increase efficiency, and put in place a clear institutional framework. Figure 4.1 also depicts central Government's confinement of policy and regulatory functions under the *Water Act of 2002* to the Ministry of Water and Irrigation (MWI). This was meant to avoid conflicts and the duplication of services that had existed under Act Cap 372, within which several government ministries and agencies had been involved in policy formulation, regulation, and service provision; these included the Ministry of Water Resources Management and Development (MWRMD), the National Water Pipeline Conservation (NWCPC), the Ministry of Agriculture (MoA), the Ministry of Local Government (MoLG), and the Ministry of Livestock and Fisheries (MoLF) (Figure 4.2).

The water service provision under Act 2002 was left in the hands of the Water Service Boards (WSBs), who are required to contract Water Service Providers (WSPs) (local authorities, municipalities, communities, non-governmental organizations, and private entities) to provide water and sanitation services within their jurisdictions. These institutional changes were based on the following principles (Mumma, 2007): (a) the separation of water management from water and sanitation provision services, to avoid the conflict of interest prevalent under Act 372; (2) the separation of policy-making from regulation; (3) the decentralization of functions to lower level state organs; and (4) the involvement of non-governmental entities in both the management of water resources and the provision of water services.

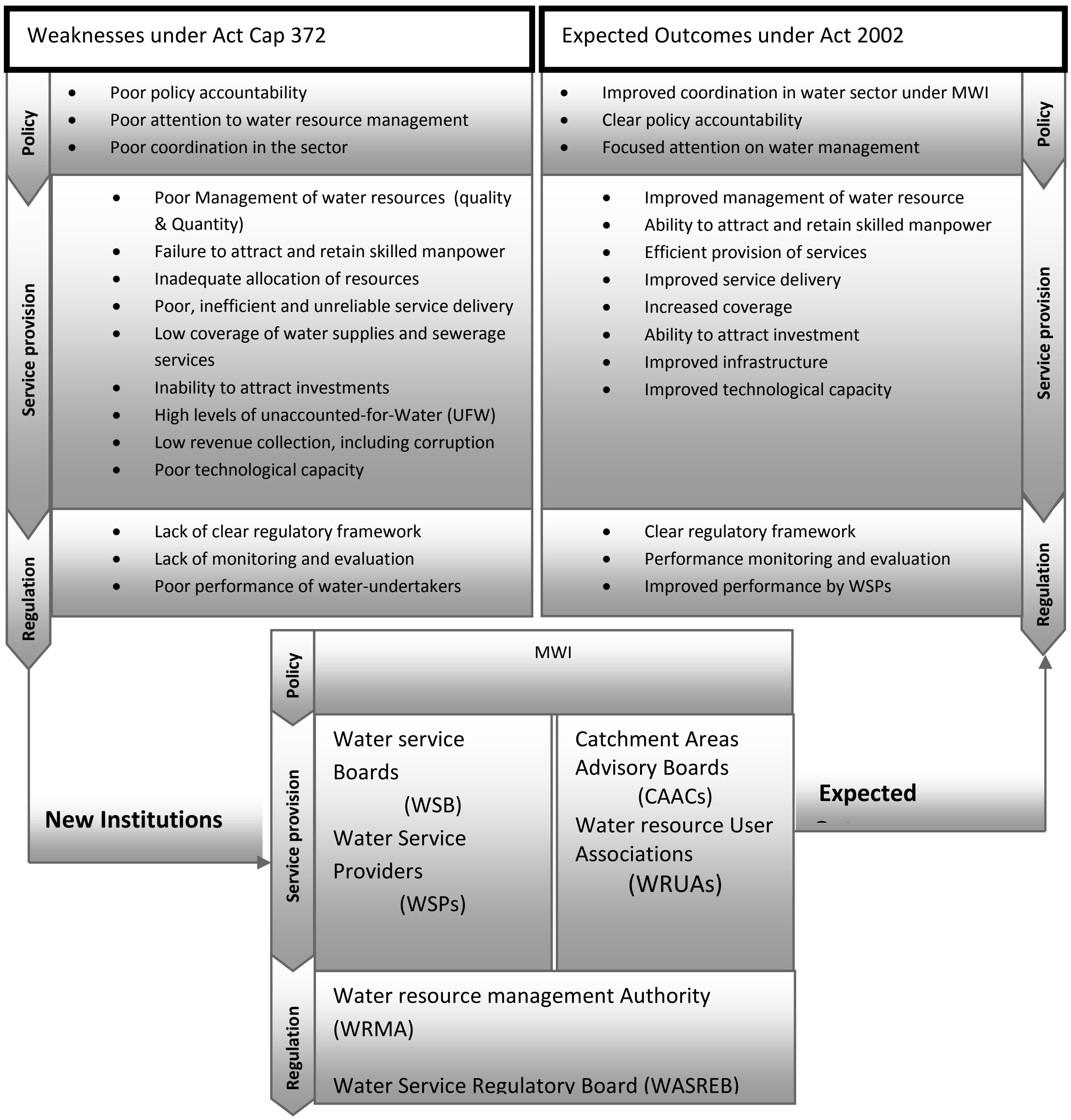


Figure 4.1: Weaknesses under Act Cap 372 and Expected outcomes under Act 2002.

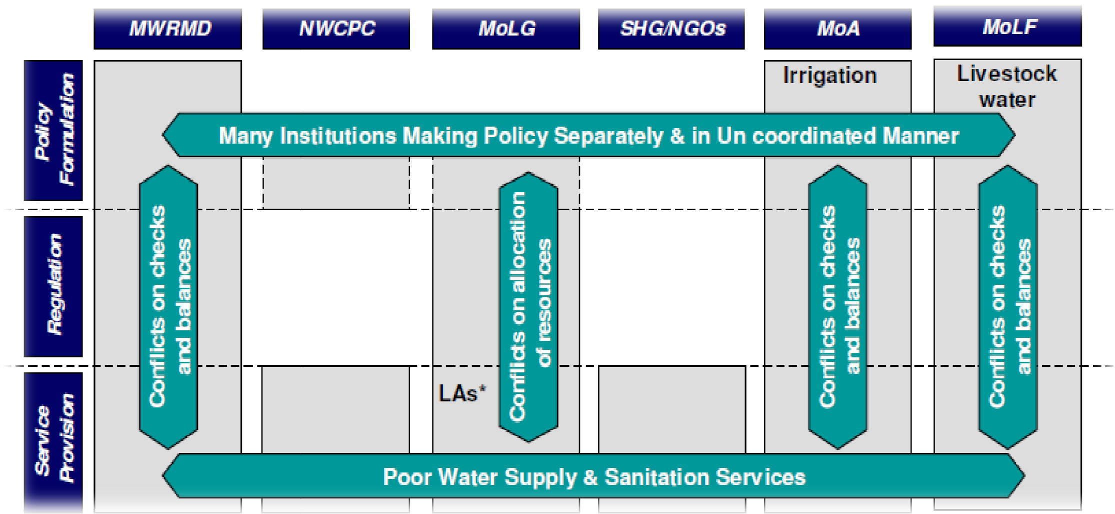


Figure 4.2: Conflicts and overlapping roles of key public institutions under the old Water Act Cap 372 (IEA 2006).

The *Water Act 2002* instituted two major management institutions. Part III of the Act is devoted to water management, overseen by the Water Resource Management Authority (WRMA), while part IV is devoted to water and sewerage service provision, under the Water Service Regulatory Board (WASREB). The Water Service Trust Fund (WSTF) was also created to finance water projects. The functions of these institutions (Table 4.2) and their subsidiaries are discussed in detail below.

Table 4.2: Roles and responsibilities of new institutions under water Act 2002

Institution		Roles and responsibilities
1.	Ministry of Water and Irrigation (MWI)	• Development of legislation, policy and strategy formulation, sector coordination and guidance, and monitoring and evaluation • Overall sector investments planning and resource mobilization
2.	Water Services Regulatory Board (WASREB)	• Regulation and monitoring of service provision (Water Services Boards and Providers) • Issuing of licenses to Water Services Boards • Setting standards for provision of water services • Developing guidelines (water tariffs etc.)
3.	Water Resource Management Authority (WRMA)	• Water apportionment and allocation • Catchment protection and conservation • Delineation of catchment areas • Gazetting water protected areas • Establishing Catchment Management Strategies (CMS) or SCMP • Collecting water use and effluent discharges
4.	Catchment Area Advisory Committees (CAACs)	• Advice on proper water resource management • Water resource conservation and allocation • Grant, adjust, cancel any permit
5.	Water Resource User Associations (WRUAs)	• Resolve conflicts arising from water use • Protect and conserve catchment areas • Ensure compliance with water Act 2002 • Facilitate exchange of ideas and information • Monitor water use availability and quality
6	Water Services Boards (WSBs)	• Efficient and economical provision of water services • Developing water and sewer facilities, investment planning and implementation • Rehabilitation and replacement of infrastructure • Applying regulations on water services and tariffs • Procuring and leasing water and sewerage facilities • Contracting Water Service Providers (WSPs)
7	Water Service Providers (WSPs)	Provision of water and sanitation services, ensuring good customer relation and sensitization, adequate maintenance of assets and reaching a performance level set by regulation
8.	Water Services Trust Fund (WSTF)	Financing provision of water and sanitation to disadvantaged groups (pro-poor) as water poverty fund
9.	The Water Appeals Board (WAB)	Arbitration of water related disputes and conflicts between institutions and organizations
10.	National Water Conservation and Pipeline Corporation (NWCPC)	Construction of dams and drilling of boreholes
11	Kenya Water Institute (KEWI)	Training and research

GoK (2002); Ministry of Water and Irrigation (2007).

4.2.3 Water Resources Management Authority (WRMA)

The WRMA is responsible for the management and conservation of water resources at the national level. The body develops national management strategies and procedures for the management of water resources according to the IWRM model. The management concept, as explained in Section 2.4, promotes “coordinated development and management of water, land related resources to maximize economic and social welfare in an equitable manner without compromising the ecosystem” (GWP 2000 p. 14). The Water Act 2002 designates the WRMA at the national scale to establish water basins as the units of water management, as opposed to previous management units which were based on political boundaries (Provinces and Districts). The institution was given the mandate to establish the tools necessary for the management of water resources in the country. These tools include the NWRMS, the IWRM plan, and the Water Resources Management Rules of 2007. The tools have been developed by the WRMA to ensure that the development and management of water resources in the six basins is well coordinated. The water resources management rules ensure equitable allocation of water as well as ensuring economic principles apply in water allocation. Figure 4.3 portrays a representation of the IWRM conceptual framework in Kenya as set up under the Water Act 2002.

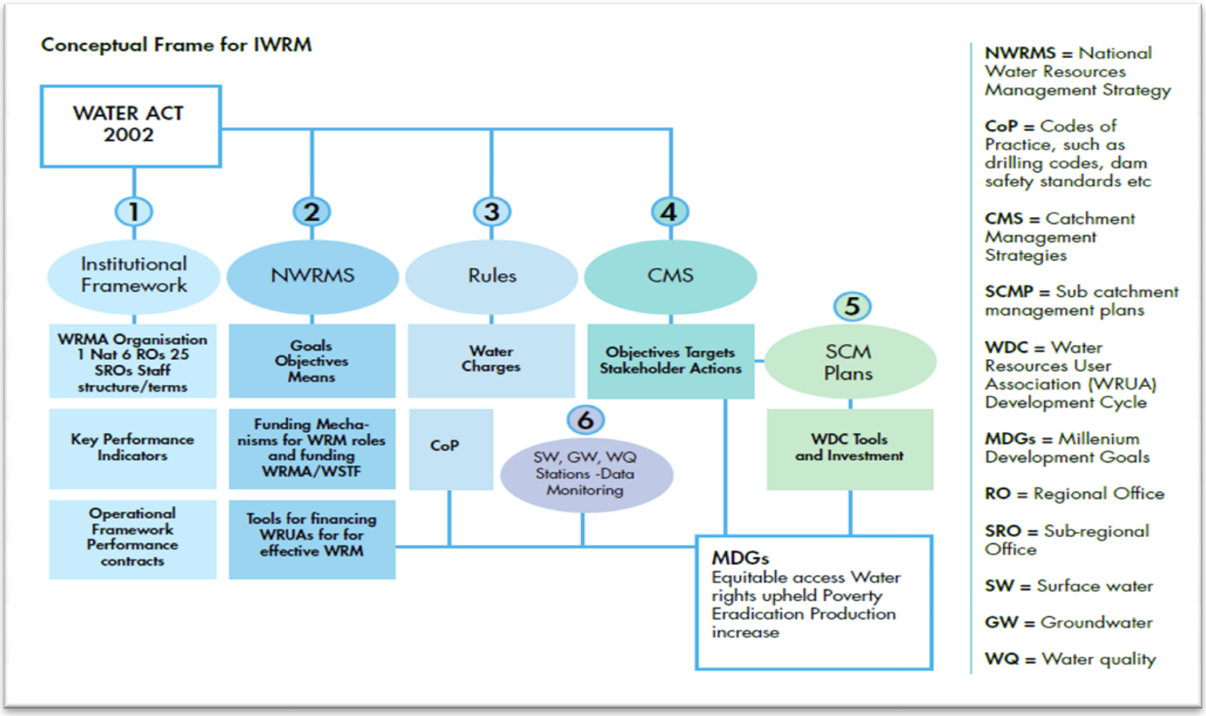


Figure 4.3: Conceptual framework for WRMA in Kenya (taken from Sida & Danida 2010).

At the regional level, the WRMA has established six Catchment Area Advisory Committees (CAACs), made up of at least 15 members appointed by the WRMA and constituting representatives of water-related institutions, regional development bodies, water resource users, the business community, and NGOs. The CAACs established in the six main water basins are the Athi Advisory Board, the Lake Victoria North Advisory Board, the Lake Victoria South Advisory Board, the Tana Advisory Board, the Rift Valley Advisory Board, and the Ewaso Ng'iro Advisory Board.

Each of the CAACs has developed a Catchment Management Strategy (CMS), guided by NWRMS. The CMSs are different and reflect the unique water conditions in the respective basins. Four out of the six catchment regions (Athi, Tana, Rift Valley, and

Ewaso Ngiro) fall within the Arid and Semi-arid Lands (ASAL) and therefore management and development plans are oriented towards creating new sources of water supply as well as conserving the current water points. The pillars of IWRM structure adopted by the six CAAS to guide the development of the CMSs are shown in Figure 4.4. The model focuses on the integration of land, water, and people, as well as monitoring to ensure equity in water resource allocation. The implementation of the CMSs is done within Catchment Management Units (CMU), which are areas of land classified based on land use and water resource condition (Table 4.3).

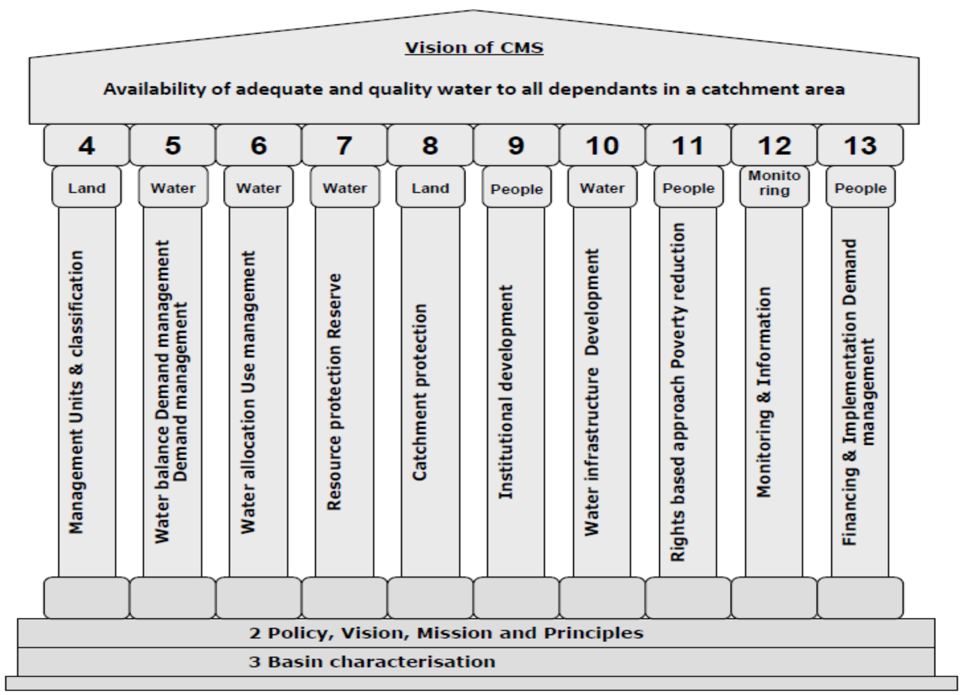


Figure 4.4: Pillars of an effective CMP (GWP, 2003).

At the sub-catchment level, Water Resources Users Associations (WRUAs) have been created to carry out the mandate of WRMA at the local level. These are formal associations of different stakeholders who register with the attorney general for the purposes of sharing, managing, and conserving water resources at a sub-catchment level. Membership of these associations falls into four categories, namely, the riparian members, abstractor members, non-consumptive members, and observer members. Any of these stakeholders can initiate the formation of a WRUA by calling a public meeting to discuss problems associated with their water resources, potential solutions,

Category	State of the water resource		
	Alarm	Alert	Satisfactory
Surface Water	Resource is periodically scarce, Water reserve threshed	Trend is towards scarcity	Water resource sufficient in quantity and quality
Ground water	Water quality or levels declining	Trend towards over-abstraction	No tangible impact
Water Quality	Catchment severely degraded, pollution levels high, risk to human life is high	Declining trend in water quality	Water quality adequate, low risk
Conflicts	Potential for conflicts is high	Ingredients for conflicts, e.g. ethnic, religious, language division	Low risks of conflict

and the possibility of organizing themselves in a formal way. If the meeting agrees to form a WRUA, then the group will call for another meeting in which they develop a constitution, choose the officials, and soon after, register with the attorney general's office. A registered WRAU, with help from the WRMA, will then develop a sub-catchment management plan (SCMP) to be eligible for funding through the Water Service Trust Fund. The SCMP identifies the problems within the sub-catchment, their causes, the corresponding activities to address the problems, and the related budgets. A Water Resources Development Cycle kit has been developed to assist WRUAs in developing the SCMP, in order to be considered for funding (Figure 4.5). The SCMP defines water resources in terms of severity, based on the information provided in Table 4.3.

Table 4.3: Zoning of catchments based on need for action.

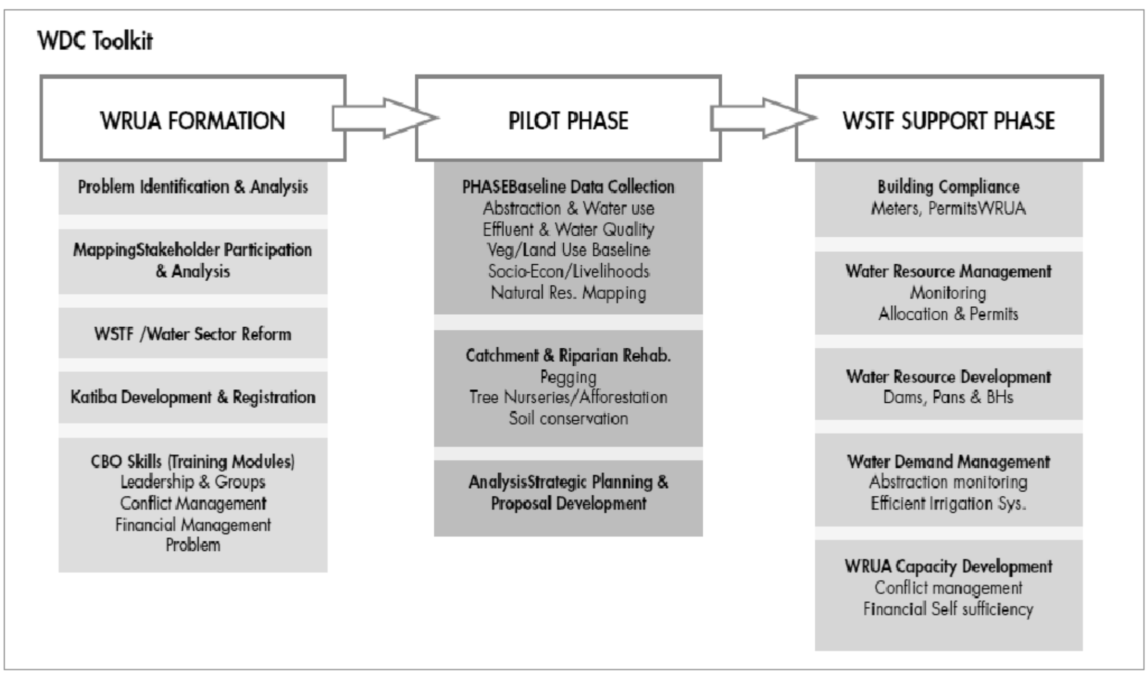


Figure 4.5: WDC toolkit (Danida/Sida 2010).

By the year 2008, about 278 WRAUs had formed in different water basins (Figure 4.6), but only 38 (13%) had received funding from the WSTF due to insufficient funds from that body. At the inception of the WRMA, it was envisaged that the institution would be self-financing. The greatest challenge for the institution is the fact that it can only raise 200 million Kenya Shillings out of one billion required for operation. The institution therefore has operated below capacity and struggles to meet its targets. Despite the fact that the WRMA has developed the CMPs in the basins, implementation of catchment action plans has been halted by insufficient funds. The problems identified by stakeholders who responded to the questionnaire survey are presented in Figure 4.7, and the two leading problems identified in the water industry relate to issues of funding (lack of funding, doubts about financial sustainability). These are followed closely by catchment destruction, corruption, water scarcity, and lack of reliable data. Flooding is cited as a problem in a small section of Lake Victoria basin while water scarcity is considered a problem mostly in the ASAL region.

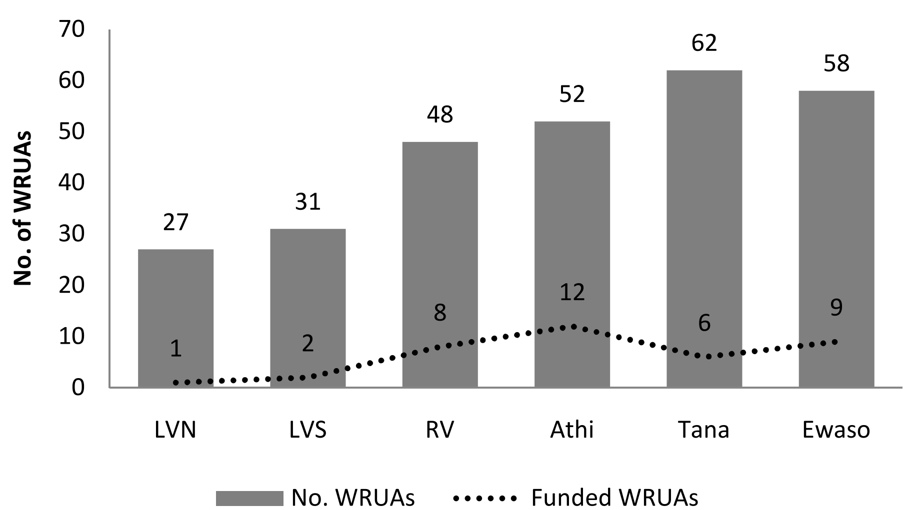


Figure 4.6: Number of WRUAs established by WRMA and Funded by WSTF in different Basins.

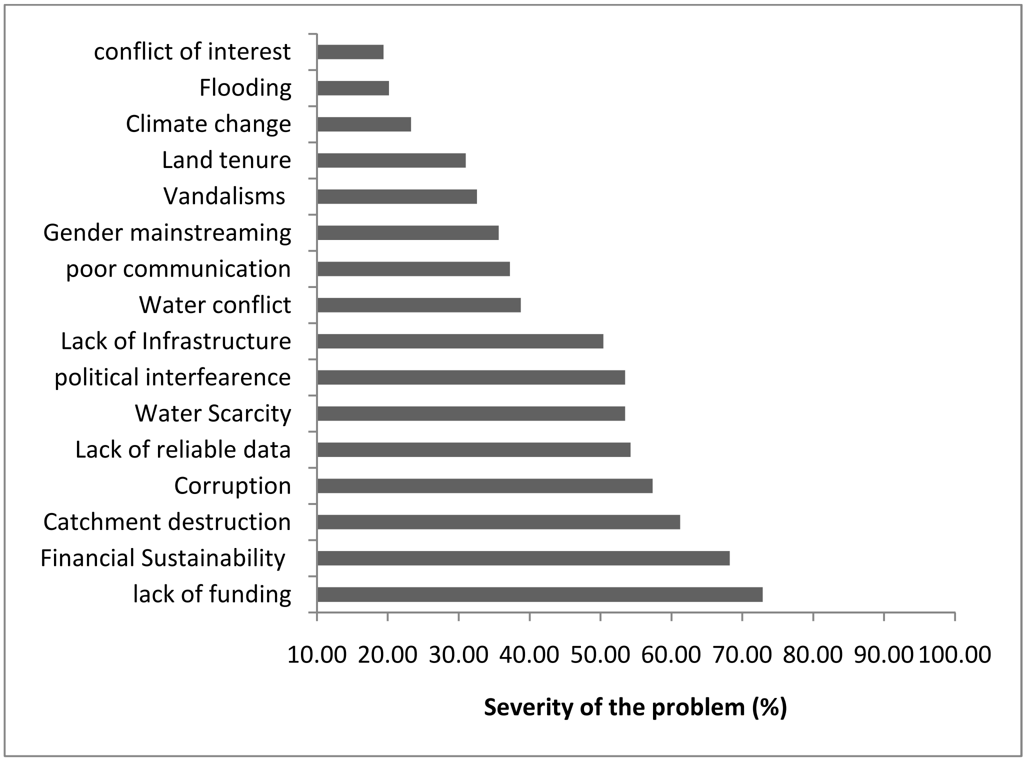


Figure 4.7: Nature and severity of problems within water sector institutions (from questionnaire survey).

Figure 4.8 further breaks down the survey data regarding problems within water sector institutions by considering the stakeholder groups (institutions) represented by the respondents. The respondents were asked to provide and rate the problems faced by their institution from the most severe to the least. Water resources experts from Moi University appeared to have the overall highest rating of problem severity; followed by the WSBs. MWI respondents appeared to have overall the most optimistic views of the severity of the problems. Otherwise, problem severity seemed to show some relationship with the interests of the stakeholder groups. For example, WSPs reported high severity ratings for lack of infrastructure, political interference, lack of funding, threats to financial sustainability, and vandalism. The WRMA was most concerned about water conflicts and the land tenure system, whereas Moi University respondents rated climate change as a much more significant problem than did other stakeholder groups. The WSTF respondents were concerned about lack of funding and threats to financial sustainability, but did not rate other potential problems particularly highly. Interestingly, representatives from WRUAs rated conflicts of interest regarding water resources lower than all other stakeholder groups.

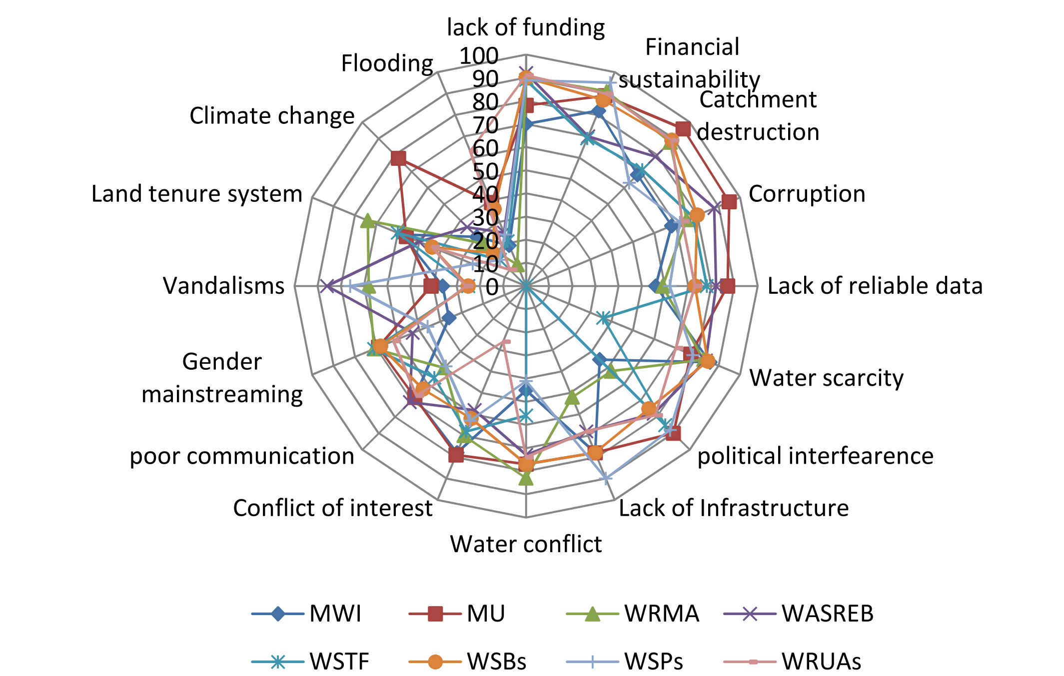


Figure 4.8: Nature and severity of problems by selected institutions (from questionnaire survey).

4.2.4 Water Services Regulatory Board (WASREB)

The water reforms give the WASREB at the national level the mandate to issue licenses to WSPs and to regulate their services (Water Act 2002). To achieve this task, the WASREB established seven WSBs at the sub-regional level (Table 4.4), spread across the country to undertake the provision of water and sewerage services within a specified area of coverage (one or more local authorities).

Table 4.4: Approved WSBs and WSPs as of May 2008.

WSB	Office headquarters	Urban WSPs	Rural WSPs	Total
Rift Valley	Nakuru	5	8	13
Northern	Garissa	7	21	28
Coast	Mombasa	6	0	6
Tana-Athi	Nairobi	9	2	11
L. Victoria North	Kisumu	4	0	4
L. Victoria South	Kakamega	10	18	28
Tana	Nyeri	17	9	26
Total		**58**	**58**	**116**

Source WASREB 2008 and WSTF 2010.

The WSBs are prohibited under the law from engaging in the direct provision of water and sewerage services, and therefore must identify a WSP at the catchment level to perform the service. This is meant to avoid a conflict of interest in having the same institution performing the functions of regulation and service provision, as was a common practice under Water Act Cap 372. However in cases where a qualified agent is not found, the WSB can provide the service. The WSPs vary in size and performance in terms of population served with water (Table 4.5). The average percentage of the population served by the WSPs is about 36%, which is far below the acceptable level of between 80 and 90% as set by the WASREB.

Table 4.5: Summary of WSPs in terms of population with access to water

WSP category	No. of WSP	Water Production million (m^3)	No. of connections	Population in service Area	People served	% population served
Very Large	4	4.6	556,970	3,509,284	1,313,742	37.4
Large	19	1.6	303,335	4,963,769	2,144,028	43.1
Medium	21	0.73	153,007	5,157,037	1,828,689	35.5
small	33	0.32	65,867	2,409,139	571,990	23.7
Total	77	7.25	1,079,179	16,039,229	5,858,449	37

Source: Compiled from WASREB 2010, WSTF 2010.

The Water Act 2002 requires the WSPs to reform their services and adopt commercial principles, and manage water not only as a social good but also as an economic good subject to market forces (Owuor & Foeken, 2009; WASREB, 2006). The principle is meant to encourage WSPs to be economically viable and to reduce their reliance on government subsidies (Chapter 5 provides a detailed analysis of the performance of WSPs). Governments in the past have been accused of inefficiencies that resulted in low water access coverage in many parts of Africa. The price of water under the new reforms should therefore reflect the market value of water and meet recovery costs. In cases where people are too poor to pay, the WSPs should institute pro-poor programs that rely on subsidies from the government. The WASREB in this case has been left with a delicate function of balancing the two seemingly divergent objectives simultaneously. On one hand, it has to formulate a tariff structure that allows WSPs to meet their costs of operation, and on the other hand it needs to maintain a lifeline policy that allows poor people access to sufficient water for basic needs.

Prior to the reforms, water providers had not seen a tariff adjustment for ten years, causing them to operate below their Operation and Management (O&M) cost (WASREB 2010). In this case, the government was forced to subsidize water and sanitation services. In 2009, the WASREB allowed a tariff adjustment across the country to cushion WSPs against high costs stemming from previous debt obligations, massive droughts, and failing infrastructure. In general, the WASREB tariff structure seeks to balance the financial sustainability of WSPs with affordability of citizens' water bills, by allowing cross-subsidies among different consumer groups and enforcing a lifeline tariff of a minimum of 20 liters per person per day from communal standpipes and community water kiosks. The tariff structure should also encourage conservation of water by discouraging flat rate fees for customers and encouraging the use of meters. Table 4.6 shows a summary of key performance indicators for licensed WSPs aggregated for different WSBs. The performance indicators considered for tariff adjustment include metering ratio, hours of service, collection efficiency, unaccounted for water (UFW), and staff per 1000 water connections. It is clear that the values of the performance indicators vary considerably between WSBs.

Table 4.6: WSBs and key performance indicators for 2008- 2009

WSB	No. of WSPs		No of WSPs below O &M coverage	Water coverage	Sanitation Coverage	Metering ratio	O &M cost coverage %	Hours of supply	Staff per 1000 connections	UFW %	Collection efficiency
Athi	S	2	3 out of 8 (38%)	58	40	92	112	13	5	40	80
	M	4									
	L	1									
	VL	1									
Coast	S	1	4 out of 6 (67%)	59	70	88	97	14	12	39	84
	M	2									
	L	2									
	VL	1									
Lake Victoria North (LVN)	S	5	7 out of 8 (88%)	47	55	86	76	18	7	51	83
	M	0									
	L	2									
	VL	1									
Lake Victoria South (LVS)	S	1	5 out of 6 (83%)	37	8	95	72	18	7	51	83
	M	2									
	L	3									
	VL	0									
Rift Valley (RV)	S	11	11 out of 14 (79%)	48	75	55	102	13	8	44	91
	M	1									
	L	1									
	VL	1									
Tana	S	5	11 out of 21 (52%)	39	66	71	106	19	10	70	91
	M	8									
	L	8									
	VL	0									
Northern	S	2	4 out of six (67%)	50	79	83	83	17	10	53	86
	M	2									
	L	2									
	VL	0									
Tanathi	S	6	8 out of 8 (100%)	22	45	63	43	12	15	55	82
	M	2									
	L	0									
	VL	0									
Total		77									

Compiled from WASREB 2010

Note: data gathered from 77 WSPs out of 118 WSPs who submitted complete data on the analyzed indicators

Legend: s =small, m= medium, l= large, VL=Very Large

Most of the WSPs are operating below O&M cost (Table 4.6). These are costs incurred in operating the water systems and include energy costs, chemical costs, maintenance, and personnel costs. Achieving the O&M cost is an indication of financial sustainability. According to the table, 3 out of 8 WSBs (Athi 112%, RV 102%, and Tana 106%) have attained the O&M cost level but they are still well below the 150% level set by the WASREB. The WSBs are also losing a lot of water due to high level of UFW, which is unaccounted for due to illegal connections, leakages due to old infrastructure, and poor accounting systems. Water coverage is still very dismal and varies from one WSB to another, from a minimum for Tana-Athi at 22 % to a maximum at the Coast at 59%. Sanitation coverage shows a wider variability in coverage. The LVS has the least coverage (8%), while the Northern WSB has the highest (70%).

4.2.5 Water Service Trust Fund (WSTF)

The WSTF was created to help finance the provision of water services to areas with inadequate coverage. The agency also has the mandate to support capacity building and initiatives that allow communities to plan and manage their water resources in a sustainable manner. This includes supporting the community in aspects such as technology choices, governance, financial viability determination, operation and maintenance training, and sanitation education. In 2008, the agency, in collaboration with WSBs and WRMA, identified 363 locations within the seven WSBs that have inadequate water supply (Table 4.7). These locations included both urban and rural areas and were identified based on water access (those with less than 20 liters per day, and a water source within in those regions and one km of residence), the poverty level (as shown in Figure 3.6), the level of investment in water and sanitation infrastructure, and the level of resource impairment as defined in Table 4.3. In the 363 targeted locations, 125 projects were funded by the WSTF between 2008 and 2009 (Table 4.7).

Table 4.7: Target Locations as and funded projects (2008/2009)

WSB	No of Targeted Locations	Funded projects
Rift Valley	51	15
Northern	55	25
Coast	50	9
Athi	51	14
L. Victoria North	56	25
L. Victoria South	49	18
Tana	51	15
Total	**363**	**125**

Note: One funded project may include several components (e.g. bore holes, wells, springs. etc).

Funding from the WSTF is made through three channels or cycles: (a) the Urban Poor Cycles (UPC) channel funds through WSPs to projects in poor urban areas such as informal urban settlements (slums), urban refugee camps, and semi-urban sub-centers; (b) the Community Project Cycle (CPC) channels money to projects in poor rural communities through Community Based Organizations (CBOs). The CPC helps communities to apply for funds and to manage their water resources and facilities in a sustainable manner; and (c) the Water Resources Users Association Development Cycle (WDC) channels money to WRAUs for management of water resources. The WDC recognizes that more than 50% of the population in Kenya relies on water supply sources such as rivers and springs. The NWRMS therefore makes provision for WRAUs to apply for funds to help manage these resources. The WDC helps WRUAs to select projects and develop sub-catchment management plans and also offer capacity building to association members as shown in Figure 4.5.

These three funding cycles are summarized in Table 4.8, which shows the number of projects completed, population covered, the cost of the projects in each category, and projections to the year 2013. Within the target locations, the WSTF will spend a total of 9.89 billion Kenya Shillings (US$12.36 million) to serve an extra 6.47 million people by the year 2013 (WSTF, 2010). Between 2005 and 2008, 192 projects were funded of which 77 have been completed and the remaining 115 remain under different stages of implementation and approval. These projects, once fully completed, will serve an additional 1.4 million people throughout the country.

Table 4.8: Projects and investment plan between 2008 and 2013.

	2008	**2009**	**2010**	**2011**	**2012**	**Total projects**	**Target Population**	**Cost (Million KSH)**	**Available funds Million KSH**
CPC	80	100	125	150	150	605	2.3	5.6	2.8
UPC	10	30	30	40	50	160	1.65	1.64	1.3
WCD	12	50	75	100	125	362	2.53	2.65	0.5
Total	102	180	230	290	325	1,127	6.48	9.89	3.6

Compiled from WSTF 2010

Funding applications and decisions for CBOs, WSPs, and WDCs is a rigorous step-by-step process which involves a transparent selection of target areas based on greatest need, selection of diverse stakeholders as officials (including women and marginalized groups), collection of relevant data, and training. A detailed process recommended for CPC application is presented in Table 4.9. The WSTF received a total of 195 project proposals under the CPC category between 2007 and 2009, of which 112 had received funding by October 2009 (Table 4.10).

Table 4.9: The five phases of CPC funding process (WSTF

1	**PRE APPLICATION** • Selection of target locations based on hardship criteria.
2	**APPLICATION** • Awareness creation by the Water Services Board (WSB) or its agent. • Application Community Based Organizations (CBOs) for support to the WSB. • Preparation and design phase contract signed
3	**PREPARATION** • Preparation meeting held between the WSB, the CBO and the SO. • Resource mapping, layout and other plans prepared. • Baseline status determined and water and sanitation services levels quantified • Training of committee and community members • Registration of CBO as a WSP is pursued from this point onwards • General Meeting approves the conceptual layout and planned activities. • Roles and responsibilities actors within the Implementation Phase are clarified
4	**DESIGN** • Detailed field survey. • Design of structures, bills of quantity and costing of works. • Financial proposal prepared. • Proposal approved by CBO and community members in a general meeting • Final proposal forwarded by WSB to WSTF
5	**IMPLEMENTATION** • WSTF releasing 1st disbursement • Material collection and construction work begins. • CBO engages suppliers and contractor as necessary. • Training in monitoring, management and finance. • Training in hygiene and sanitation continues. • Product based payments made by the Water Service • Trust Fund (WSTF), after field monitoring by the WSB or its agent Final field assessment to ensure satisfactory completion of contract and quantification of actual improvement in water and sanitation service levels.
6	**POST IMPLEMENTATION** • End of defects liability period if applicable. • Long term monitoring to measure the sustainability of improved water and sanitation

Table 4.10: Status of CPC project proposals as of October 2009

WSB	Received proposals from 2007-2009	Internally approved proposal	Funded projects	Additional proposal being appraised	Completed projects
Athi	16	5	0	11	0
Coast	11	9	9	2	0
LV north	36	34	25	2	4
LV South	21	19	16	2	1
Northern	31	29	16	2	0
Tana	58	45	27	13	2
Rift Valley	22	19	19	3	1
Total	**195**	**160**	**112**	**35**	**8**

Njue, 2009

Funding for such projects comes both from the Kenyan Government and development partners (Table 4.11). Development partners include the Swedish International Development Agency (Sida), Danish International Development Agency (Danida), German Development Agency (GTZ), The World Bank, UN-HABITAT, African Development Bank (ADB), and United Nation Children Funds (UNICEF). The yearly expenditure over the last five years has been variable, but it is clear that the government has relied heavily on foreign sources of funds (comprising 77% of the total funding) in order to finance the projects.

Table 4.12 gives a summary of all project components planned and completed between 2007 and 2009, based on information reported by survey respondents. The table shows the slow pace of project completion. By the end of 2009, only 27 % of bore holes, 30% of spring protection, 16% of wells, and 5% of water kiosks (vending shops) had been completed.

Table 4.11: Project Funding (Kenya Shillings) from the government of Kenya and Development Partners (DPs) (2005-2009)

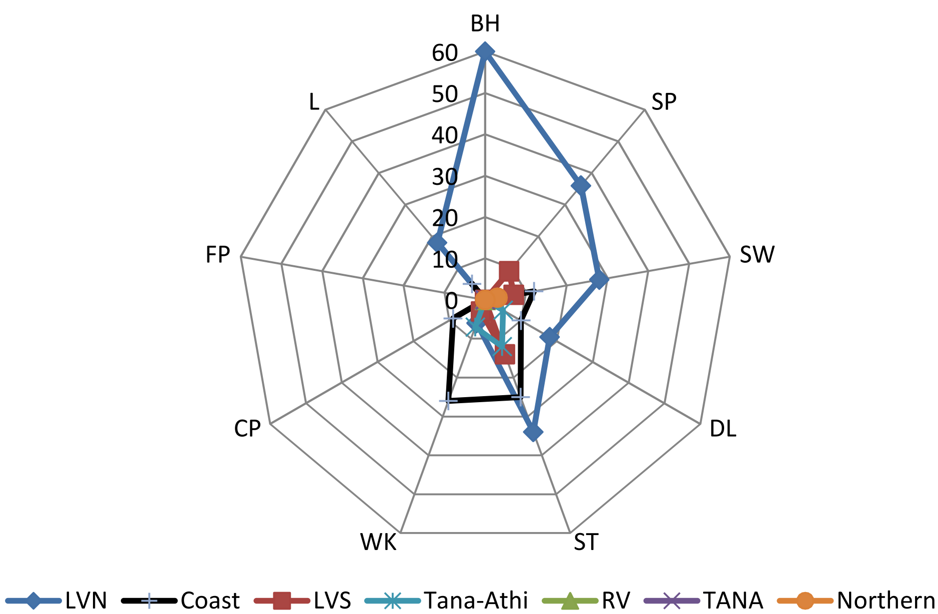
Source	2005	%	2006	%	2007	%	2008	%	2009	%	Total	
Government of Kenya	53,392,275	20%	49,390,000	37%	118,529,920	45%	65,000,000	11	96,985,937	21%	**383,298,132**	**23%**
		Contributions from development Partners (DPs)										
Sida	60,000,000		85,000,000		69,500,000		248,706,360		150,000,000		**613,206,360**	
Danida	151,793,316		--------		69,499,000		248,706,360		60,350,000		**530,348,676**	
GTZ	-------	------	--------		4,000,000		10,300,000		10,300,000		**24,600,000**	
ADB	-------	-------	---------		-----------		--------------		50,348,530		**50,348,530**	
World Bank	--------	-------	----------		-----------		--------------		41,104,764		**41,104,764**	
UN-HABITAT	---------	--------	-----------		------------		-------------		41,104,764		**41,104,764**	
UNICEF	----------	--------	-----------		------------		------------		17,387,300		**17,387,300**	
Sub-Total: DPs	**211,793,316**	**80**	**85,000,000**	**63**	**142,999,000**	**54**	**507,712,720**	**88**	**370,595,358**	**79%**	**1,318,100,394**	**77%**

Table 4.12: Summary of project components planned and completed between 2007 and 2009.

WSB	Boreholes (BH)		Spring protection (SP)		Shallow wells,(SW) Cattle troughs		Distribution lines and (DL)pumping		Storage tanks (ST)		Water kiosks (WK)		Communal water points (CP)		Filtration points (FP)		Latrines (L)	
	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
Lake Victoria North	20	12	106	38	128	36	22	4	50	17	103	6	11	0	0	0	268	48
Lake Victoria South	9	0	21	2	39	3	23	0	34	5	66	2	9	0	1	0	110	14
Rift Valley	5	0	2	0	33	0	5	0	10	0	14	0	7	0	0	0	28	0
TANA	0	0	0	0	0	0	4	0	4	0	16	0	0	0	0	0	14	0
TANA-ATHI	1	0	1	0	42	2	32	4	54	4	94	0	4	0	0	0	192	0
Northern	16	0	8	0	29	1	37	0	17	0	31	0	1	0	1	0	81	0
Coast	0	0	0	0	8	1	2	2	8	2	23	6	23	2	0	0	23	2
Total	**52**	**12**	**139**	**42**	**280**	**45**	**126**	**12**	**178**	**30**	**348**	**16**	**56**	**4**	**3**	**2**	**717**	**66**
% of complete projects	**27**		**30**		**16**		**10**		**16**		**5**		**7**		**66**		**9**	

Note: P is planned projects; C is completed projects. Source: Respondents to questionnaire survey.

Figure 4.9 indicates there is great disparity in project completion rates across the different WSBs. The diagram shows that LVN WSB is leading the rest by having 60% of boreholes, 36% of spring protection projects, 34% of storage tanks, and 28% of shallow wells completed. The coast WSB is a distant second with all its projects within a 25-30% range of completion. The remaining WSBs have project completion rates below the 10% level, except the Rift Valley and Tana which have not completed any projects within this time period. The graph also show disparities in the types of projects completed. Many WSBs show some progress in completing storage tank projects, followed by distibution lines, and shallow wells.



Key: Boreholes (BH), Spring protection (SP), Shallow wells (SW), Distribution lines pumping (DL), Storage tanks (ST), Water kiosks (WK), Communal water points (CP), Filtration points (FP), Latrines (L).

Figure 4.9: Comparison of project completion rates in different WSBs.

4.3 Stakeholder Participation

Management of water resources in the face of water scarcity is complex and uncertain, and affects different stakeholders in society in different ways. A core principle of IWRM, therefore, is to include the participation of stakeholders as a means of tapping local knowledge to boost the management of water resources (Reed, 2008). Stakeholder participation has many benefits in resource management. Studies have shown that stakeholder involvement may reduce the marginalization of minority communities as well as increase their trust in decision-making processes (GWP, 2003; Reed, 2008). In such cases, the descisions are percieved as holistic, fair, and accounting of diversity in society. Reed (2008) notes that the participation of stakeholders can empower them through co-generation of knowledge with researchers, while increasing the possibility that they will use the knowledge for management. This process will increase the social learning of the participants, which may later translate to reflective deliberation during descision making. The involvement of stakeholders also enables technologies to be better adapted to local conditions, thereby accelarating the rate of adoption of such technologies and enhancing the mantainance of projects. According to the International Association for Public Participation (IAP, 2007), the following seven principles should guide participatory process:

- Public participation is based on the belief that those who are affected by decision have a right to be involved in the decision-making process.
- Public participation includes the promise that the public contributions will influence the decision.

- Public participation promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision makers.
- Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision.
- Public participation seeks input from participants in designing how they participate.
- Public participation provides participants with information they need to participate in a meaningful way.
- Public participation communicates with participants how their input affected the decision.

Table 4.13 shows the levels to which different WSBs involve their citizens in decision-making processes (as revealed from questionnaire survey respondents). Athi and Tana water service boards lead the rest. These two WSBs have reached the level of collaboration where they use techniques such as citizen advisory meetings, consensus building, and participatory decision-making processes. Lake Victoria North and South (LVN and LVS), as well as northern and coast water service boards, are only at the initial stages of stakeholder engagement, characterized by an information-giving stage using instruments such as facts sheets and websites.

Table 4.13 Stakeholder participation in different WSBs in Kenya.

Increasing Level of stakeholder Participation →

		1.Inform	2.Consult	3. Involve	4. Collaborate	5. Empower
	Techniques	1.Fact sheets 2. Websites 3. Open days	1. Public comments 2. Focus groups Survey	1. Work shops 2. Deliberate polling	1. Citizen advisory meetings 2. Consensus building 3 Participatory decision making	1. Citizen Juries 2. Ballots 3. Delegated decisions
WSBs	LVN	1	0	0	0	0
	LVS	1	0	0	0	0
	Rift Valley	1	1	1	0	0
	Athi	1	1	1	1	0
	Tana	1	1	1	1	0
	Northern	1	0	0	0	0
	Coast	1	0	0	0	0

Note: Results are from questionnaire survey.

Participation ranges from category one (inform), to the highest level (empower), where stakeholders are presumed to have a large say in decision-making processes as well as in management.

Key: 1 indicates presence of specified techniques while 0 indicate absence of the techniques

4.4 Evaluations and Conclusions

Over the last several decades, the Kenyan government has implemented a series of reforms in the water sector. First, the system was reformed from traditional communal management system based on customary law to a system based on British common law during colonial rule (between 1885 and 1963). Before colonial rule, water management was embedded within cultural frameworks that varied from one region to another. During the colonial period, the British imposed a dual system of governance based on land rights. The “Crown Lands” taken from the indigenous people were governed by statutory laws introduced from Britain while the “Native Lands” set aside for the Africans were governed by customary laws. The development of water infrastructure within the native lands was minimal compared to that in crown lands. The colonial government prohibited any construction of water facilities without colonial approval. Section 145 of the ordinance, in particular, prohibited damming of a spring or a river without express permission of the colonial government. The policy was meant to give the colonial government full control over the water supply of the country in order to satisfy the imperial quest for agricultural expansion in the White Highlands, which was a major supplier of agricultural raw material in east Africa (Nyanchaga & Ombogi, 2007).

After independence in 1963, the system changed to a centralized system of management. In this system, the government set a goal to ensure access to potable water at a reasonable distance (two kilometers of residence) to all Kenyans by 2000. To facilitate the process, the Kenyan government developed strategies guided by the National Water Master Plans (NWMP) of 1974, 1979, and 1992. All these master plans had one point in common—they placed the burden of water provision in the hands of government. While some progress was made during this period (16.1 million people out 31 million had access to water), the problems of budget constraints, poor inter-linkages with water-related sectors, and increased population especially in urban areas, forced the government to consider decentralization of water provision services to allow private sector participation in the services.

By 2000, the target of ensuring water availability to everybody as identified by the NWMP 1974 had not been reached. With a population standing at 31 million in 2000, only half of the population (51%) had access to potable water. This forced the government to once again change the water policy. The shift in water policy coincided with an emerging privatization agenda fronted mainly by the World Bank and multi-national corporations, especially in developing countries (Shiva, 2000; Bakker, 1995; Yeboah, 2006). This agenda provided an impetus for the accelerated transfer of production, distribution, and management of water services away from the government, with the hope that such a move would foster competition among different Water Service Providers (WSPs) and boost performance. The policy shift was intended to solve the government's failures, which had resulted in dismal performances in the provision of drinking water and sanitation services over the last century (WASREB, 2009).

The new water policy as defined in the Water Act of 2002 therefore reduced the government's role to policy and regulatory functions. Provision of water and sanitation services was decentralized and left to WSPs (comprising local authorities, municipalities, communities, non-governmental organizations, and private entities). The policy shift mirrored governance principles crafted in international conferences on water and environment, especially the Dublin principles and Agenda 21 of the Rio de Janeiro meeting in 1992. Agenda 21 recommended the Integrated Water Resource Management (IWRM) as an effective governance model for water resources, while the Dublin principles encouraged the introduction of economic measures in water management. It also encouraged private sector participation as well as gender mainstreaming in water management.

In many respects, the recent (2002) water reforms have achieved several milestones especially at policy and institutional arrangement levels. Decentralization of roles and responsibilities has been clearly demarcated and key institutions have been set up. Water sector strategies have also been developed. These include the NWSS to serve a water service delivery blue print and the NWRMS to serve a water management blue print. Several target locations for water development needs have also been identified to guide the funding priorities. Within the 363 target locations identified, only 125 projects had been funded by 2008, and while 195 CPC proposals were submitted to the WSTF between 2007 and 2009, only 160 were approved and 112 funded. To date only 8 of those projects have been completed. The slow progress in project completion, and the high level of proposal rejection, underscores the reality that development of water access in the country remains dismal. The UNDP (2008) estimates the latest coverage for improved drinking water access in Kenya at about 50% (60% in urban areas and 40% in rural areas), while sanitation stands at 52% (65% in urban areas and 40% in rural areas). However, previous surveys by the Central Bureau of Statistics indicate that sanitation coverage in many parts of the country is through traditional pit latrines which do not meet the definition of improved sanitation (CBS, 2004). In addition, the percentage access coverage to safe water and sources of drinking water varies from region to region.

Therefore, universal access to water services still eludes the government of Kenya, with a major constraint being insufficient funds for water projects. The government relies heavily on foreign donors to fund identified projects: between 2006 and 2009, the government contributed a meager 23% compared to 77% from foreign donors. These funds from development partners fluctuate from year to year (2006 63% of the total project funds, 2007 54%, 2008 88%, and 2009 79%), making it hard to make consistent planning decisions regarding water targets. According to the WSTF, this fluctuation is fuelled by many factors including: eroding donor confidence due to corruption and instability in the government (especially after the 2007 election); macro-economic instability caused by high inflation; shifting priorities by donors (for example, funding humanitarian projects rather than development projects); and high interest rates on the loans. The WSTF (WSTF, 2010) also blames the slow implementation of the projects on poor understanding of funding mechanisms and procedures by stakeholders such as WSBs and WSPs, and on poor institutional management due to poor staff capacity as measured both in terms of numbers and experience. At the community level, the majority of WRAUs are characterized by high illiteracy levels and poor technical capacities, resulting in poor management and misappropriation of funds. Nor has funding for water projects been immune to political interference. According to the Daily Nation (2010, Nov. 1), the minister of Irrigation (Mrs. Charity Ngilu) is accused of steering funds for drilling boreholes to her area of representation in Ukambani region and ignoring other needy areas. In addition, natural factors have also constrained the pace of the reforms. Drought conditions that hit the country between 2008 and 2009 severely affected water project development, and massive floods at the end of 2009 and beginning of 2010 caused severe damage to water sector infrastructure.

Chapter Five: Performance Analysis of Water Service Providers in Kenya

5.1 Introduction

Kenya has undergone tremendous reforms guided by a new national water policy that took effect in the year 2000 (WASREB, 2009). The policy called for decentralization of water management and water service provision to allow participation of private and community entities in the provision of water services through WSPs. Decentralization was seen as a quick and effective way to achieve the goals of MDGs, through strengthening water management and water access to many people. This chapter uses Data Envelopment Analysis (DEA) to analyze the performance of WSPs in meeting this goal. The method is detailed in section 3.5. Briefly, DEA is a non-parametric method that applies linear programming to input and output data to estimate a piece-wise approximation of the best production frontier or best practice frontier within a given set of firms, generally referred to as decision making units (DMU) (Charnes, Cooper, & Rhodes, 1978). In this study, the DMUs are the Water Service Providers (WSPs). The best-performing DMUs make up the frontier (benchmark) which envelops the less efficient firms. The relative efficiencies of these firms are calculated on a scale of 0 to 1, with the best performing DMU receiving a score of 1. The performance of a DMU is measured as the distance of the DMU from the production frontier (deviation from best practice), which serves as a target or benchmark for the less efficient DMUs (Anwandter & Ozuna, 2002).

5.2 Historical and Institutional Context of Water Service Providers (WSPs)

5.2.1 The Emergence of Privatization

During most of the 20th century, the emphasis in water development was focused on tapping new supplies, with governments (especially in the developed world) being at the center of planning, management, and financing of water resource projects (Bakker, 2005). During this period, water played a major strategic role in facilitating industrialization, urbanization, and agricultural development (Gleick, 1990). Accelerated development over time, however, led to increasing water scarcity, forcing governments to shift emphasis from creating new sources of water supply to managing demand of existing water resources (Bakker, 2005). The UN World Water Development Report (2003) portrays water scarcity as a governance problem to be mitigated by social, environmental, economic policies, and advocates the decentralization of delivery and management services to private and community entities. The push for water privatization gained a lot of momentum after the International Conference on Water and Environment was held in Dublin in 1992, and a global discourse was initiated on the viability of decentralization and privatization of water services as a solution for water scarcity.

Since the declaration of the Dublin Principles, many countries have realigned their water sector policies with the emerging privatization agenda fronted mainly by the World Bank and multi-national corporations (Shiva, 2000; Bakker, 1995; Yeboah, 2006).

The declaration provided an impetus for the accelerated transfer of production, distribution, and management of water services from government entities to the private sector, with the hope that such a move would foster competition among different companies and therefore boost productivity and efficiency. The move was also intended to solve the failures of governments that had resulted in dismal performances in the provision of drinking water and sanitation services over the last century (WASREB, 2009).

As discussed in Chapter 4, Kenya has undergone tremendous reforms guided by a new National Water Policy (WASREB, 2009). In effect, the policy change introduced privatization of water service and sanitation provision in the country. Privatization describes a range of policy initiatives, meant to shift the ownership or management away from the government in favor of the private sector (Nyangena, 2008). Unlike liberalization, in which the government relinquishes all the ownership and operation of water services, the Kenyan government opted for commercialization, where the government retains the ownership but leases out some services to private companies (Nyangena, 2008). Such leases include service contracts (such as billing), management contracts and leases for existing facilities (operating existing facilities without any private sector investment), and concessions (requiring private sector investments in the facilities). Privatization can also be in a form of liberalization in which the government cedes complete ownership to private entities (such as in divestitures) (Kirkpatrick, Parker, & Zhang, 2006; K’akumu, 2004).

To this end, the country was demarcated into seven Water Service Boards (WSBs), which oversee the distribution of water and sanitation services within their jurisdictions by contracting water services provisions to WSPs. The WSPs are required to operate under a commercial framework in which they re-invest (ring fence) some of their profits to expand service delivery. However, these WSPs are structured as regional monopolies, with limited or no competition, and are therefore prone to price manipulation and have little incentive for providing high quality service and arranging customer protection (Thanassoulis , 2000; Coeli et al., 2003; Giannakis, Jamasb, & Pollitt, 2005). This is because the amount of capital needed to lay out water and distribution systems is very high and discourages many companies from getting into the market. Also, once the system has been laid out, most customers are connected to it and have no choice of another distributor.

5.2.2 Benchmarking of WSPs

To alleviate the aforementioned potential monopolistic problems, the government created WASREB as a regulatory agency, to regulate water and sanitation services within different jurisdictions in the country. The role of WASREB is to establish regulatory laws and rules that replicate the discipline found in competitive markets, in order to ensure that these new private and community enterprises are efficient in meeting the MDG targets relating to water supply and sanitation services. In order to achieve such, the regulatory agency introduced a benchmarking process to encourage comparative competition among WSPs (WASREB, 2009). Benchmarking is simply a comparison of some measure of a firm's actual performance against a reference or benchmark performance (Andersen & Pettersen, 1996; Giannakis, Jamasb, & Pollitt, 2005). This could be done by comparing a firm's performance against the best-performing companies under similar conditions in the same industry, or could be based on a predetermined level of ideal performance. Benchmarking therefore quantifies the relative performance of different firms while controlling for external or environmental factors in order to identify areas for improvement (Berg, 2007). Benchmarking methods can be classified as average- or frontier-oriented (Giannakis, Jamasb, & Pollitt, 2005). The average methods compare a company's performance against some ideal level of average performance, while the frontier measures a company's performance against an efficient frontier or best practice scenario (See section 3.5.1 for a detailed explanation).

In theory, the benchmarking process holds WSPs accountable to achieve stipulated minimum service levels (MSLs) (Table 5.1), as well as to constantly evolve and improve in order to survive as water-providing entities and meet MDG targets. The relevant regulatory agency, namely, the WASREB, is required to revoke the licenses of WSPs which do not meet the targets specified in their Service Provision Agreement (SPA). These include targets in the areas of water coverage, unaccounted for water (UFW), revenue collection efficiency, metering ratio, service duration, and water quality.

The benchmarking process is very important in improving efficiency on various fronts (Giannakis, Jamasb, & Pollitt, 2005; Corton & Berg, 2009). First, benchmarking requires that a company's performance information be made public. Public awareness in this regard helps place pressure on utility regulators, politicians, and company managers to perform at their optimum levels and as a result build customer confidence. Second, the benchmarking process helps companies set reasonable targets that promote cost containment and determine the most effective path to achieve these targets. This should help save resources by focusing on areas of weaknesses and strengthening areas of success. Third, the benchmarking process can be used for tariff review. According to the Kenyan Government, tariffs of all WSPs will be linked to the achievement of key benchmarks in areas such as water quality, hours of service, reductions in unaccounted for water (UFW), and collection efficiency (WASREB, 2009). Fourth, and last, the benchmarking process will help potential investors analyze the cost effectiveness of different WSPs before they make their investments.

5.2.3 Regulatory Framework and Performance Analysis

Regulation in the Kenyan water sector was initiated as part of the overall water sector reform to protect consumers while at the same time holding WSPs accountable to the terms of their contracts; these terms include clear guidelines regarding efficient service deliveries, quality of service, and economic viability of the WSPs. As a consequence of the 2002 water reforms, all public water companies previously owned by municipal and local authorities were privatized. The commercialization form of privatization adopted in Kenya is meant to create a free-market-like condition in public service delivery through better cost recovery, improved water quality, increased duration of service, reduction in UFW, and increased water coverage (K'akumu, 2004; Nyangena, 2008). By 2009, 118 such companies had been registered to assume service in their assigned geographic regions. The WSPs are spread across different WSBs in the country, and are classified as rural or urban WSPs (see section 4.2.4 for further details on WSPs).

5.3 Data

The data used for this analysis were taken from the WASREB impact report (WASREB, 2009), and includes input-output information for 55 WSPs out of the 118 registered with the WASREB, collected during the 2006-2008 period (Table 5.1). The selection of the 55 WSPs was based on the availability of complete data as shown in Tables 5.6, 5.7, and 5.8 for large, medium, and small WSPs, respectively. For the analysis, further adjustments were also made regarding the data. Very large companies in terms of the number of water connections (Mombasa: 57,304, and Nairobi: 218,627), and very small firms (Nyandarua north: 25, Upper Chania: 362, Vihiga DWO: 390, Olkalou: 626, and Tachasis: 699) were excluded to avoid distortion of DEA results caused by outliers. In addition, Nithi, Imentha, and Rumuruti WSPs were excluded because of insufficient data. These exclusions were made based on the fact that DEA analysis allows firms of similar mixes of inputs and outputs to be compared to each other. For the purpose of unbiased comparisons (i.e. to allow comparisons for similarly-sized units), the WSPs were further grouped into three categories following the WASREB method of grouping: small WSPs (fewer than 5,000 connections); medium WSPs (5,000-10,000 connections); and large (10,000-35,000 connections). The connections reflect the size of population served by the WSPs, with large companies with many connections serving more people than smaller WSPs. This grouping will allow weak WSPs to be benchmarked with companies which are similar in size, but which are doing much better in terms of SPA targets.

The general methodology of the Data Envelopment Analysis (DEA) is contained in Section 3.5, and the specification for the particular DEA model used for WSP efficiency and performance analysis is presented in Section 3.5.2.4. DEAfrontier software, developed by Zhu (2009), was used to solve the DEA model and to provide the following information: The TE and SE of each WSP; output and input slacks (unused potentials in a firm); efficient service targets for each firm; and peer companies to act as role models for poorly performing firms. The results of the model were then compared to the minimum level benchmarks (Table 5.1) recommended by the WASREB, in an attempt to determine the extent to which the WSPs are facilitating progress towards achieving the MDGs.

Table 5.1: Minimum Level Service (MLS) geared towards achieving MDGs.

<table>
<tr><th colspan="2">Service Indicator</th><th>MDG Target
(Minimum yearly targets)</th><th>Poor performance</th></tr>
<tr><td colspan="2">Water coverage (% population)</td><td>> 90%</td><td>< 30%</td></tr>
<tr><td colspan="2">Revenue collection efficiency</td><td>> 90%</td><td>< 50%</td></tr>
<tr><td colspan="2">Unaccounted for water (UFW)</td><td>< 20%</td><td>> 70%</td></tr>
<tr><td rowspan="2">Hours of water supply</td><td>Population > 100,000</td><td>24-20 hours</td><td><8 hours</td></tr>
<tr><td>Population < 100,000</td><td>> 16 hours</td><td>< 4 hours</td></tr>
</table>

Source: (WASREB, 2009)

5.4 Efficiency Results

The results of DEA efficiency for the analyzed WSPs are reported in Table 5.2. The table contains scores for the efficiency parameters (TE and RE) for 44 WSPs (15 large, 11 medium, and 18 small). The mean TE score of the large WSPs is 0.71, which shows that on average the large WSPs could reduce their inputs by 29% and still produce at the same output level. The medium size WSPs could reduce their inputs by 12% (0.88 efficiency), while the greatest reduction would be 43% for the small WSPs which have a mean TE of 0.57. The results show that many WSPs are doing poorly in terms of their efficiencies with large WSPs doing slightly better than the medium ones. This could be attributed to many factors including insufficient capital investments, lack of trained personnel, dilapidated infrastructure and excessive UFW. The results for small WSPs are also represented in Figure 5.1. The figure shows that fifty percent of small

WSPs operate at a TE level of less than 0.5. However, three firms in the small WSP category (Lamu, Mt. Elgon, and Muthambi) have TE scores of 1.00, indicating that they form the frontier to which all other WSPs' efficiencies are referenced in this category.

The mean SE score for large WSPs is 0.87, indicating that they can reduce their input use (per unit of output) by an average of 13% if they change their scales of operation. The firms could change their scale of operation by either increasing investments in their systems in order to reach more customers, or clustering (amalgamating) with other smaller companies.

The results support the fact that most WSPs are too small to be economically viable and attract private investments, and are suffering under the burden of past liabilities including loans and electricity bills (MWI 2008). The medium size WSPs could reduce their input by 6% and the small WSPs by 29% if they similarly change the scales of their operation. Table 5.2 also shows that four WSPs (27%) in the large WSPs category have TE efficiency scores above 0.9 and none is below 0.5 efficiency level. The majority of the large WSPs (11, or 73%), fall in the middle with TE values between 0.5 and 0.8. Seven (64%) of the medium WSPs have TE above 0.9, with one below 0.5. In the small WSPs category, only 16% of the firms have a TE over 0.9, while 33% operate in the 0.5-0.8 range, while the majority (50%) operates below 0.5 TE, indicating that they need to change their scale of operation.

Table 5.2: Summary of WSP efficiency results

	WSPs Efficiencies							
WSP's Size (n)	TE				SE			
	0.9-1.00	**0.5-0.8**	**<0.5**	**Mean**	**0.9-1.0**	**0.5-0.8**	**<0.5**	**Mean**
Large (15)	4	11	0	**0.71**	11	3	1	**0.87**
Medium (11)	7	3	1	**0.88**	10	0	1	**0.94**
Small (18)	3	6	9	**0.57**	5	6	7	**0.71**

To determine the robustness of efficiency scores, a second stage regression of TE score was run against contextual or environmental factors which would affect efficiencies and which cannot be controlled by managers. These are factors such as income levels and rainfall distribution. In this case, rainfall was used as a proxy for environmental factors, and the results of the regression (not reported) show that the coefficients were not significant (at 5 and 10 %), hence validating efficiency scores from the DEA model.

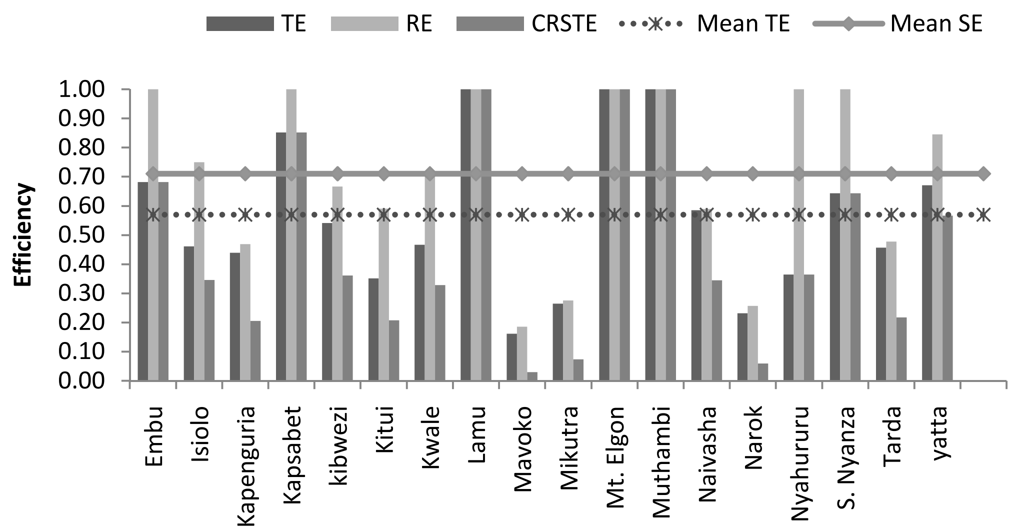


Figure 5.1: Efficiencies for small WSPs.

5.5 Water Coverage

Water coverage measures the ratio of population served to total population living within the service areas of the WSPs. Six large WSPs (Amatisi, Kahuti, Kirinyaga, Kisumu, Mathira and Western) are considered poor performers and are operating below the minimum level benchmarks (Figure 5.2)considered as yearly incremental steps towards achieving MDGs in 2015. All of these firms, except for Kirinyaga, are operating below their capacities as defined by model targets. If they were to operate at their full capacity, they would move above the poor performance level but not high enough to reach the 90% minimum yearly service level geared towards achieving the MDG. In addition, while all WSPs above the poor performance level are operating at full capacity as defined by model targets, none of them is on track to achieve the MDG target, indicating that most of the firms still need investments to improve their capacity in order to extend coverage to a larger population. Kirinyaga is a good example of a firm which needs investments. Despite the fact that it is operating in full capacity (Figure 5.2), it can only extend coverage to 20% of the population within its jurisdiction.

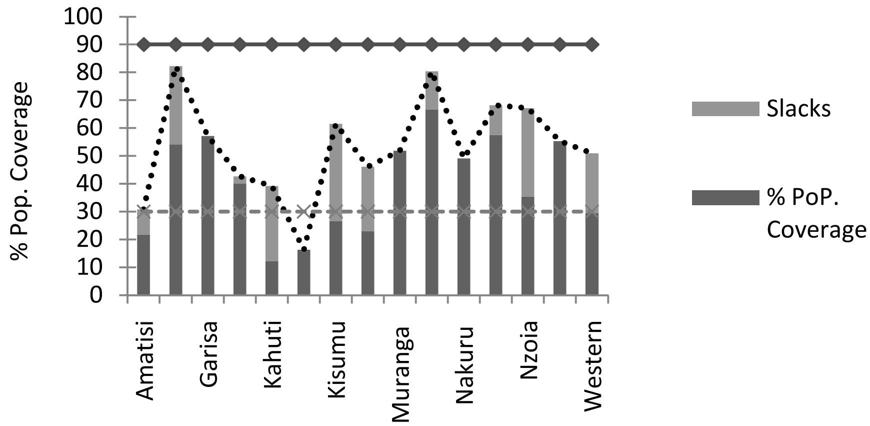


Figure 5.2: Water service coverage and targets for large WSPs.

In the medium WSPs category (Figure 5.3), none of the WSPs has achieved the interim MDG target level for water coverage. Three of the WSPs (Embe, Oloolaiser, and Tururu) are operating at full capacity, yet they lie below the poor performance level. Two firms (Kericho and Muranga) have unutilized potential. If Kericho increases its scale of operation to utilize all its slack capacities, it will reach the minimum benchmark level. The small WSPs (Figure 5.4) are performing worse than the other size categories. Out of the 18 WSPs analyzed, 13 of them are below the poor performance level and are operating below their capacity. Only four of the firms would move above the poor performance level if they increase their scale of operation. None of the WSPs in this category has reached the interim MDG target and none has any potential to get to that level.

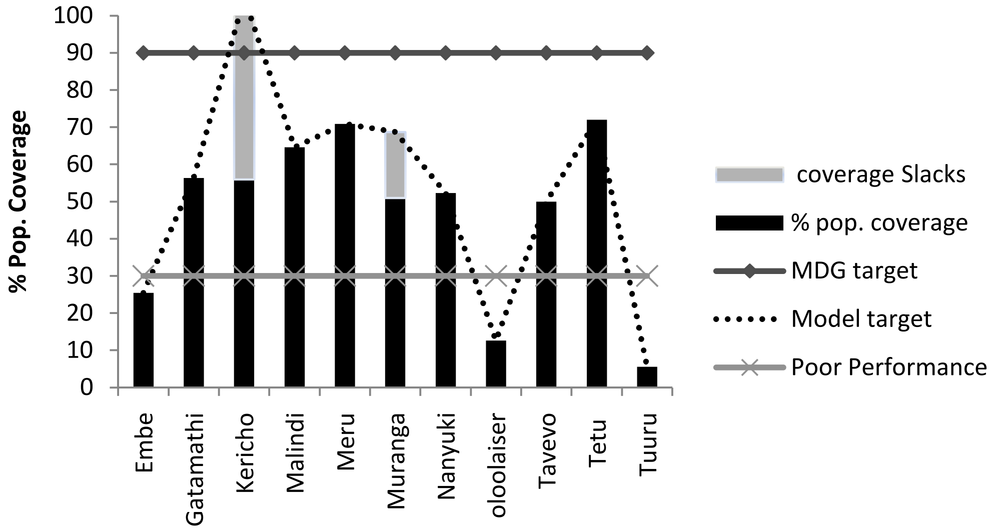


Figure 5.3: Water service coverage and targets for medium WSPs

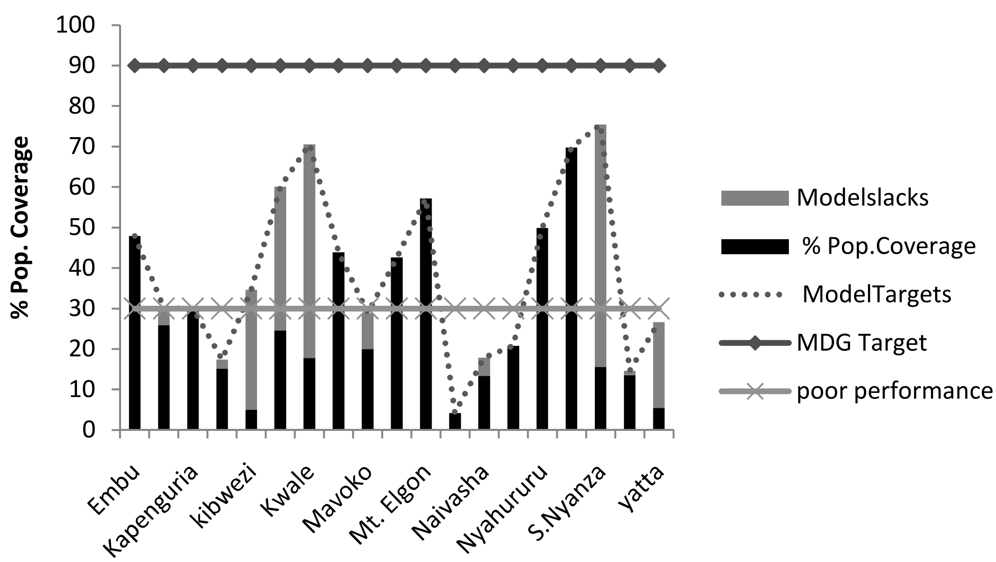


Figure 5.4: Water service coverage and targets for small WSPs.

5.6 Unaccounted For Water (UFW)

Unaccounted For Water (UFW) represents the disparity between the quantities of water produced for distribution by WSPs and the actual quantity of water billed. It represents the difference between net production and consumption of water. This disparity may occur due to technical losses (e.g. leakages) and/or commercial losses (illegal connections, unbilled customers, wastage on un-metered customers) (WASREB, 2009). Many countries in Africa experience a high level of UFW due to aging infrastructure and illegal connections (Bayliss, 2003). For large WSPs (Figure 5.5), 10 out of the 15 companies (67%) have more than 50% of water that is not accounted for. None of the firms has met (i.e., come below) the relevant interim MDG target for UFW (<20% UFW), while four firms (Garissa, Kahuti, Kirinyaga, and Othaya) are in the poor performance category (over 70% UFW).

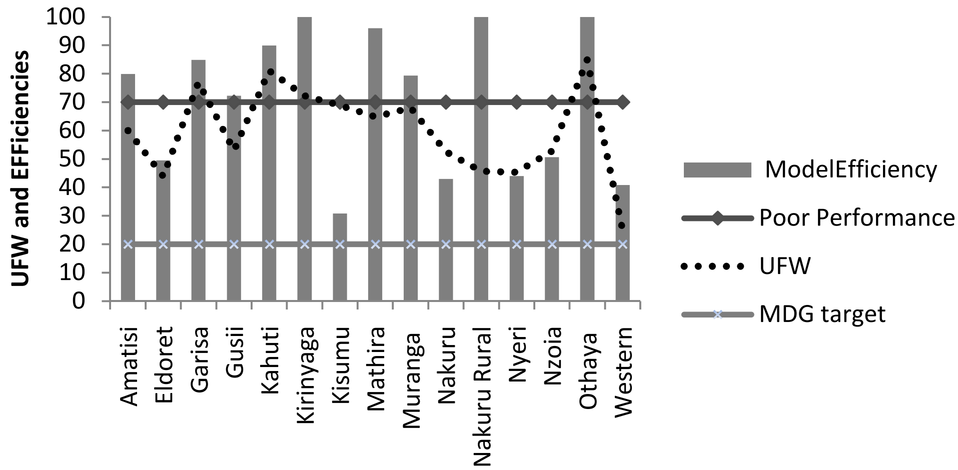


Figure 5.5: UFW and targets for large WSPs.

In the Medium WSPs category (Figure 5.6), none of the firms has achieved the MDG interim targets, while four (Embe, Gatamathi, Muranga, and Tururu) are above the poor performance category (over 70 % UFW). Malindi and Meru are doing far better with UFW values of 25% and 28%, respectively. In the small WSPs category (Figure 5.7), none of the companies has reached the MDG target, and 12 out of the 19 WSPs (63%) have a UFW value exceeding 50%. Lamu, Naivasha, and Tarda-Kiambere are the best of this category, with UFW values of around 30%.

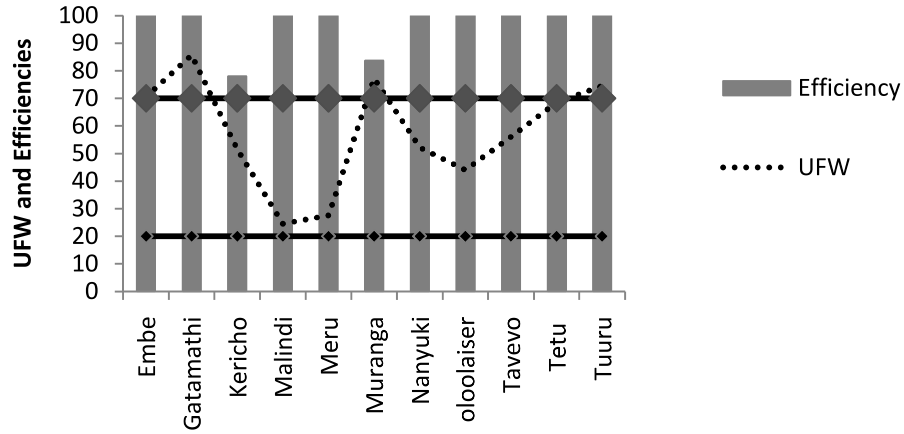


Figure 5.6: UFW and targets for medium WSPs.

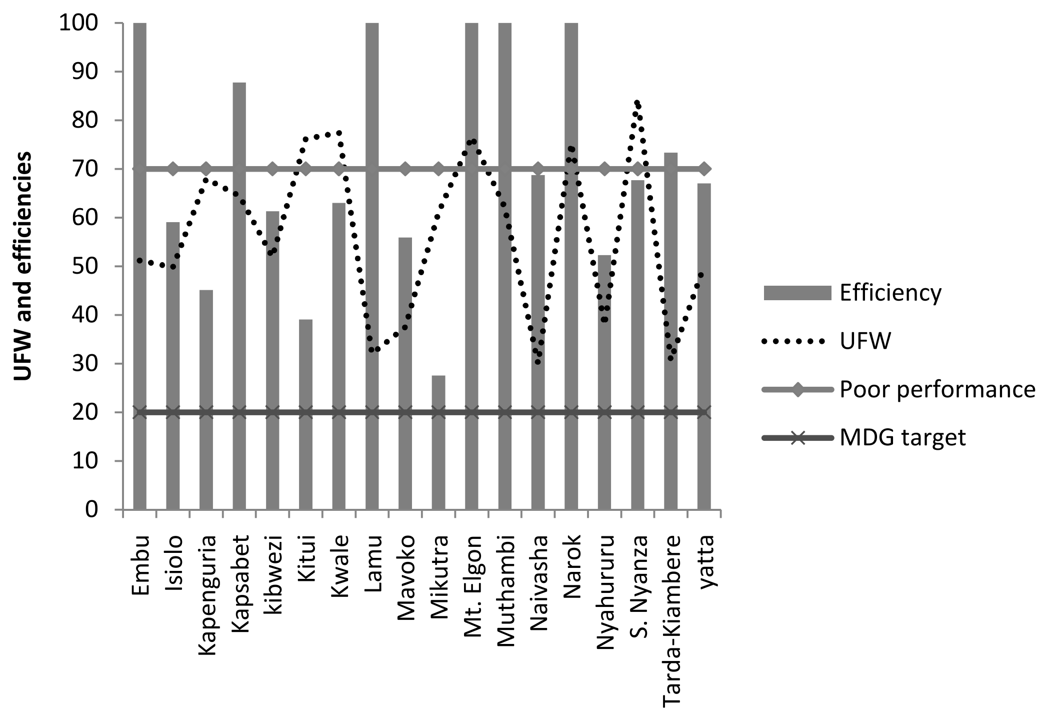


Figure 5.7: UFW and targets for small WSPs.

5.7 Hours of Water Supply

The hours of supply defines the average number of service hours per 24-hour day that a WSP is able to provide water service (WASREB, 2009). Figures 5.8, 5.9, and 5.10 depict the service and target data for hours of supply for large, medium, and small WSPs, respectively. For the large WSPs, all firms except Muranga are above the poor performance level and four firms (Eldoret, Kirinyaga, Nyeri, and Othaya) have reached MDG targets (Figure 5.8). Muranga and Garisa have untapped potential which, if utilized, will propel them to MDG interim targets, and Nakuru almost so.

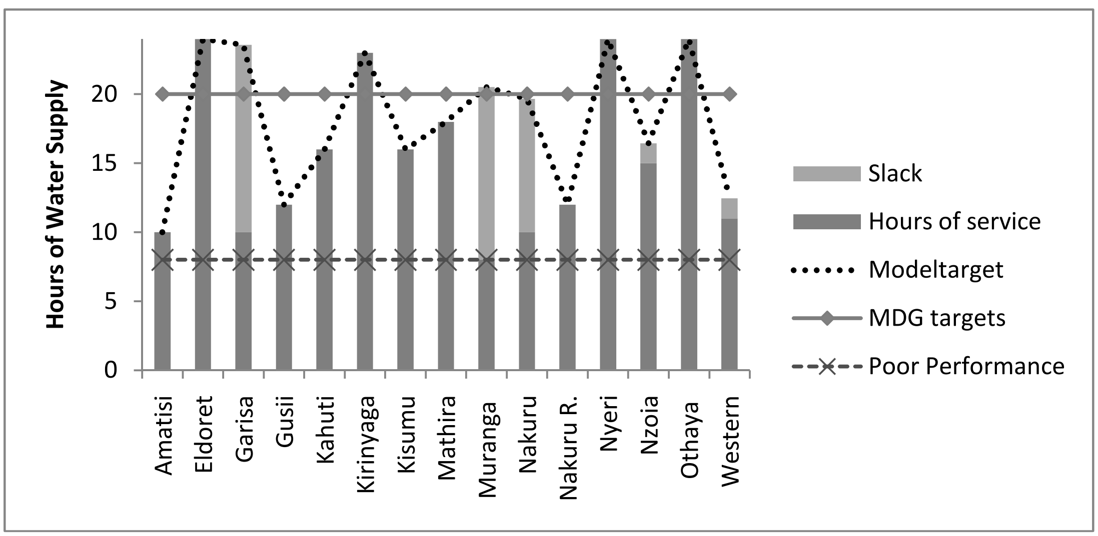


Figure 5.8: Hours of water supply and service targets for large WSPs.

Regarding the medium scale WSPs (Figure 5.9), all the firms are working at their full capacities, and none of them is working below the poor performance level. Out of 11 companies evaluated, six have reached the required MDG target, and another two are close to achieving the target.

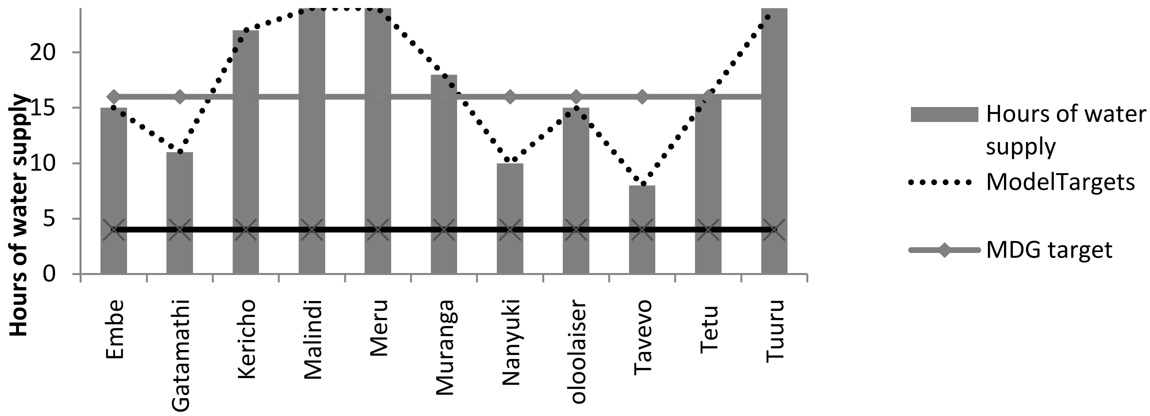


Figure 5.9: Hours of water supply and service targets for medium WSPs under constant return to scale.

Figure 5.10, representing small WSPs, reveal that while all firms (except Mavako) are above the poor performance level, 42% (8 WSPs) are operating below their capacity. Five of the firms have achieved the MDG interim target, while two (Kwale and S. Nyanza) need to use their underutilized capacity to reach the target.

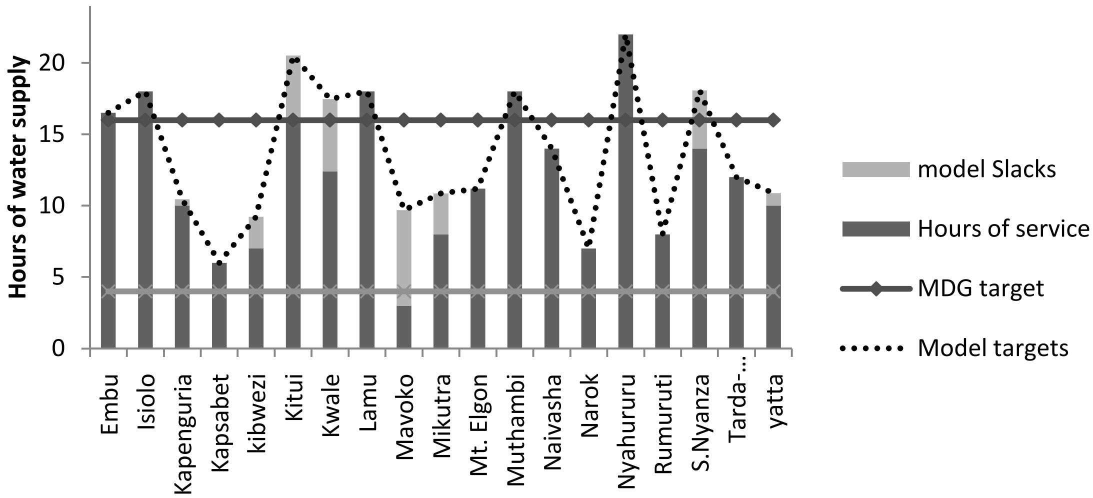


Figure 5.10: Hours of water supply and service targets for small WSPs.

5.8 Collection efficiencies

Collection efficiencies define the percentage of billed revenue that is actually collected. Within the period of analysis, most firms did well in collection efficiencies. Of the 15 large WSPs, six have met the MDG targets (Figure 5.11). All the large WSPs are working at their maximum capacity except for Garisa. Garisa is, additionally, the only large WSP that is currently operating at below the poor performance level of 50%, although if it worked at maximum capacity it would exceed this value by some margin. A similar situation is seen for the medium WSPs (Figure 5.12), with all the WSPs operating at full capacity except for Kericho, which, even though it has reached the MDG target level, still has potential to improve. The small WSPs (Figure 5.13) are doing equally well, with none of the firms operating below the poor performance level. Eleven out of 18 WSPs have reached the MDG target level, and out of these five still have underutilized capacity. Collection efficiencies above 100% indicate that the companies are very efficient at collecting revenues including previous arrears.

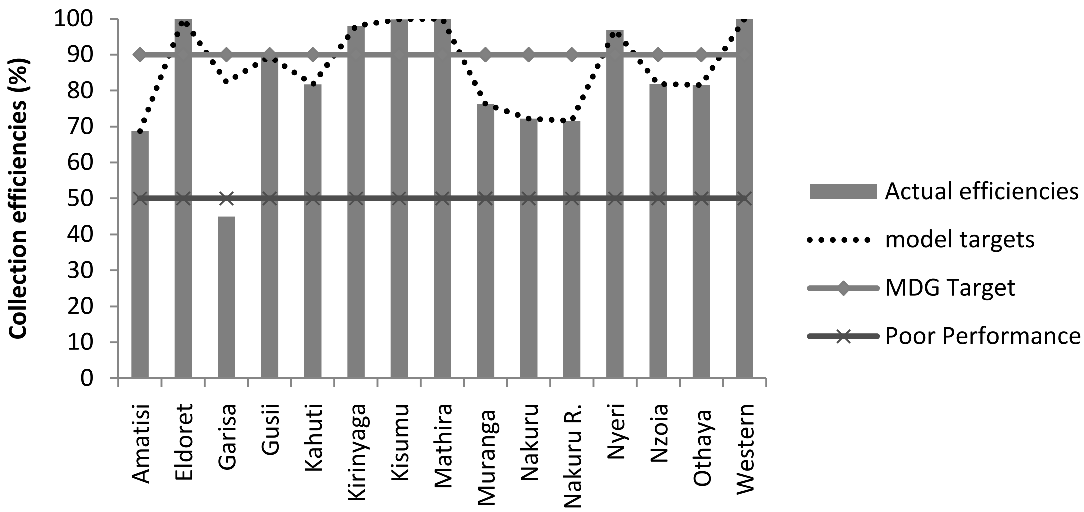


Figure 5.11: Revenue collection efficiencies and targets for large WSPs.

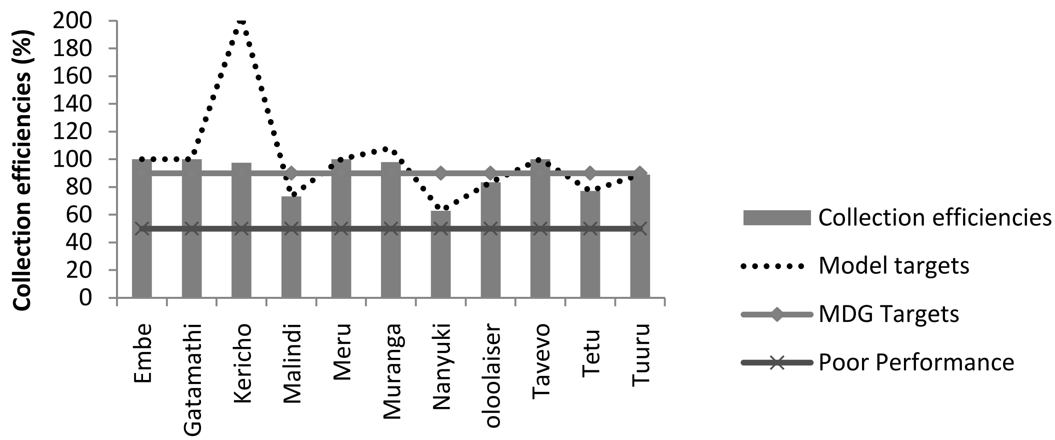


Figure 5.12: Revenue collection efficiencies and targets for medium WSPs.

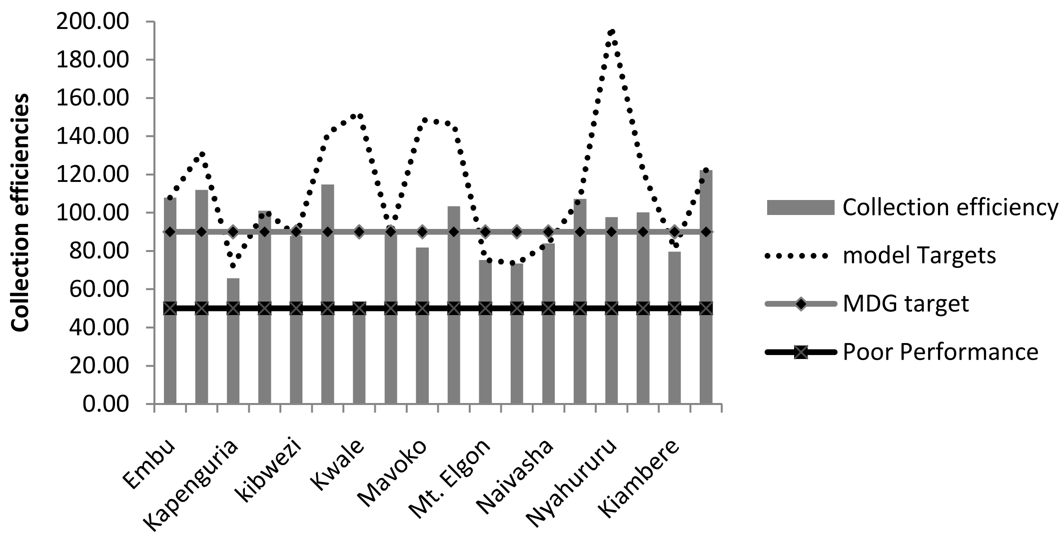


Figure 5.13: Revenue collection efficiencies and targets for small WSPs.

5.9 Benchmarking Peers

The DEA results identify the efficient WSPs that will be used as benchmarks for inefficient WSPs to emulate. The efficient firms have similar input-output mixes to those of inefficient WSPs. Tables 5.3, 5.4, and 5.5 present lists of large, medium, and small WSPs, respectively, with their corresponding benchmark peers. The most efficient WSPs are found at the bottom of the tables and the least efficient at the top, with the efficient firms having no benchmark to emulate apart from themselves. The frequency with which a particular WSP is used as a benchmark indicates that the firm outperforms many WSPs in that category. Conversely, the higher the number of WSPs a firm can use as a benchmark, then the weaker that WSP in terms of efficiency.

Table 5.3 shows that Gusii is the worst-performing WSP in terms of meeting its target and therefore has been assigned four benchmark WSPs (Othaya, Eldoret, Nakuru, and Nakuru Rural) which it can emulate. The table also shows that Nakuru and Nakuru rural are the most frequently used benchmarks, indicating that these firms are the most appropriate role models because they are doing much better than other WSPs at meeting their targets. Tables 5.3, 5.4, and 5.5 therefore show that Gusii, Muranga, and Nyahururu are the least efficient firms in the large, medium, and small firm categories, respectively. For the medium WSPs, two firms (Muranga and Kericho) are clearly inferior to the other nine in the category, which have only themselves as peers.

Table 5.3: Benchmark Peers for large WSPs.

DMU No.	DMU Name	No of PEERS	Peers			
1	Gusii	4	Othaya	Eldoret	Nakuru	Nakuru R.
2	Kahuti	3	Othaya	Nakuru	Nakuru R.	
3	Amatisi	3	Othaya	Nakuru	Nakuru R.	
4	Western	3	Eldoret	Nakuru	Nakuru R.	
5	Nzoia	3	Eldoret	Nakuru	Nakuru R.	
6	Mathira	3	Othaya	Nakuru	Nakuru R.	
7	Garisa	2	Othaya	Nakuru		
8	Muranga south	2	Othaya	Nakuru		
9	Kisumu	2	Eldoret	Nakuru		
10	Kirinyaga	0	Kirinyaga			
11	Othaya	0	Othaya			
12	Eldoret	0	Eldoret			
13	Nakuru	0	Nakuru			
14	Nakuru R	0	Nakuru R			
15	Nyeri	0	Nyeri			

Table 5.4: Benchmark Peers for medium WSPs.

DMU No.	DMU Name	Number of Peers	Peers			
1	Muranga	4	Tetu Aberdare	Meru	Tavevo	Gatamathi
2	Kericho	3	Tuuru	Meru	Tavevo	
3	Embe	0	Embe			
4	Gatamathi	0	Gatamathi			
5	Malindi	0	Malindi			
6	Meru	0	Meru			
7	Nanyuki	0	Nanyuki			
8	oloolaiser	0	oloolaiser			
9	Tavevo	0	Tavevo			
10	Tetu Aberdare	0	Tetu Aberdare			
11	Tuuru	0	Tuuru			

Table 5.5: Benchmark Peers for small WSPs.

DMU No	DMU Name	No. of Peers	PEERS				
1	Nyahururu	5	Rumuruti	Muthambi	Narok	Mt. Elgon	Embu
2	Kapenguria	4	Rumuruti	Muthambi	Narok	Mt. Elgon	
3	kibwezi	4	Muthambi	Narok	Mt. Elgon	Embu	
4	Kitui	4	Muthambi	Narok	Mt. Elgon	Embu	
5	Tarda-Kiambere	4	Rumuruti	Muthambi	Narok	Embu	
6	Isiolo	3	Muthambi	Mt. Elgon	Embu		
7	Kapsabet	3	Muthambi	Mt. Elgon	Embu		
8	Kwale	3	Narok	Mt. Elgon	Embu		
9	Mavoko	3	Rumuruti	Narok	Embu		
10	Naivasha	3	Muthambi	Mt. Elgon	Embu		
11	South Nyanza	3	Narok	Mt. Elgon	Embu		
12	Mikutra	2	Mt. Elgon	Embu			
13	Yatta	2	Muthambi	Lamu			
14	Embu	0	Embu				
15	Lamu	0	Lamu				
17	Mt. Elgon	0	Mt. Elgon				
18	Muthambi	0	Muthambi				
19	Narok	0	Narok				
20	Rumuruti	0	Rumuruti				

Table 5.6: Data for large WSPs (10,000-35,000 water connections)

Inputs (to be minimized)					Outputs (to be maximized)				
Company	**Number of Employees**	**Average Gross Salary per month (Ksh)**	**UFW**	**Dormant water connections**	**Number of water connections**	**Hours of service**	**Metering Ratio**	**Average gross monthly Revenue (KSH)**	**% drinking water coverage**
Garisa	60	13579.13	77	32.06	11054	10	86.65	1792214.4	57.14
Kahuti	43	16006.74	80.99	72.78	11883	16	26.34	813802.09	12.13
Nyeri	111	36630.77	45.3	16.15	13185	24	100	11034678.72	57.5
Muranga	63	12786.88	68	76.02	13426	8	24.35	497965.23	51.88
Amatisi	58	11210.6	60.02	54.34	13821	10	2.15	1064400.92	21.75
Gusii	98	7218.58	53	36.85	18913	12	63.46	1437458.12	40
Othaya	47	11344.21	84.91	52.95	14448	24	9.15	1233121.61	55.34
Western	135	14925.67	24.88	53.85	15532	11	42.25	5478225.75	29.46
Kirinyaga	62	9375.09	72.25	46.45	16731	23	48.84	2314680.72	16.24
Nzoia	178	19437.96	52.8	31.45	25379	15	61.46	5572103.1	35.39
Eldoret	181	25334.19	43.92	1.37	25784	24	100	20517627.86	54.15
Nakuru	213	25600.38	52.54	7.88	25961	10	59.90	27177916.05	66.67
Kisumu	154	29468.34	68.88	32.06	14102	16	100	15154964.44	26.54
Mathira	58	9773.81	64.76	56.14	16323	18	39.66	2015181	22.96
Nakuru Rural	130	2888.06	45.64	37.5	34434	12	18.30	7549829.3	49.05
Summary statistics									
Mean	106.07	16372.02	59.66	40.52	18065.07	15.53	52.17	6910277.95	39.75
median	98	13579.13	60.02	37.50	15532.00	15.00	48.84	2314680.72	40.00
SD	56.08	9218.41	16.33	21.62	6733.83	5.80	33.31	8155148.02	17.42
Min	43	2888.06	24.88	1.37	11054.00	8.00	2.15	497965.23	12.13
Max	213	36630.06	84.91	76.02	34434.00	24.00	100	27177916.05	66.67

Table 5.7: Data for Medium WSPs (5,000-10,000 water connections)

Inputs (to be minimized)					**Outputs (to be maximized)**				
Company	**Number of Employees**	**Average Gross Salary per month (Ksh)**	**UFW**	**Dormant water connections**	**Number of water connections**	**Hours of service**	**Meter Ratio**	**Average gross monthly Revenue (KSH)**	**% drinking water coverage**
Embe	64	10656.14	70.6	49.91	9793	15	18.92	654916.48	25.44
Gatamathi	23	14509.95	85.62	58.3	7471	11	5.59	612141.09	56.31
Kericho	164	13579.64	51.47	17.9	9377	22	100	4851087.2	56
Malindi	39	71145.98	24.6	4.84	8102	24	100	11445917.73	64.57
Meru	70	24250.57	27.61	10.76	5344	24	94.53	5484619	70.88
Muranga	61	18101.09	77.26	6.42	6933	18	73.47	2033452.69	51.03
Nanyuki	83	23820.01	52.1	20.51	7284	10	53.59	7527444.3	52.3
oloolaiser	70	4476.58	44.07	36.03	7327	15	37	858002.6	12.59
Tavevo	81	3866.13	56.15	29.38	7014	8	100	3439333.71	50
Tetu Aberdare	37	12403.98	68.5	0	5266	16	47	1200288.14	72
Tuuru	105	3086.22	74.5	35.3	5232	24	97.58	1230717.6	5.56
Descriptive Statistics									
Mean	72.45	18172.39	57.50	24.49	7194.82	17.00	66.15	3576174.59	46.97
Median	70.00	13579.64	56.15	20.51	7284.00	16.00	73.47	2033452.69	52.30
SD	38.29	19024.09	19.97	19.04	1534.17	5.90	35.43	3479445.00	22.56
Minimum	23.00	3086.22	24.60	0.00	5232.00	8.00	5.59	612141.09	5.56
Maximum	164.00	71145.98	85.62	58.30	9793.00	24.00	100	11445917.73	72.00

Table 5.8: Data on Small WSPs (fewer than 5000 water connections)

Inputs (to be minimized)					Outputs (to be maximized)				
Company	**Number of Employees**	**Average Gross Salary per month (KSH)**	**UFW**	**Dormant water connections**	**Number of water connections**	**Hours of service**	**Meter ratio**	**Average Revenue (KSH)**	**% drinking water coverage**
Embu	50	1042531.5	51.18	0	4970	16.5	100	4394639	47.9
Isiolo	52	876411.12	49.8	12.28	3131	18	77.47	1930340.36	25.86
Kapenguria	32	146488.96	67.95	0	791	10	4.80	383332.8	30
Kapsabet	11	129773.05	64.47	61.81	1288	6	38.93	175978.44	15.15
kibwezi	23	66730.82	51.88	33.24	1775	7	84.64	419452.84	4.95
Kitui	62	278390.54	76.15	10.83	2863	16	100	714484.28	24.61
Kwale	61	384974.05	77.42	44.78	4149	12.4	62.72	2087763.43	17.78
Lamu	40	23582	32	16.81	1487	18	100	598470	43.88
Mavoko	72	2345641.2	37.5	0	1700	3	98.00	4894486.56	20
Mikutra	66	1147669.38	61	44.45	2549	8	22.03	379707.9	42.6
Mt. Elgon	22	19798.02	76.57	58.9	3209	11.2	0.76	250083.24	57.14
Muthambi	12	46428.48	62.1	9.1	989	18	99.33	140870.04	4.18
Naivasha	28	415290.12	30	14.79	2028	14	6.83	895876.8	13.33
Narok	52	538260.84	75.21	14.67	1704	7	99.31	6644499.16	20.82
Nyahururu	78	965984.76	37.84	1.05	3660	22	97.09	2669577.3	49.9
South Nyanza	43	113482.59	84.37	14.51	4032	14	66.51	607161.29	15.57
Tarda-Kiambere	29	611706.86	30.7	24.36	1593	12	100	1718527.82	13.53
Yatta	25	26192.5	50.1	17.61	721	10	100	132877	5.41
Descriptive Statistics									
Mean	40.63	494043.62	55.91	22.26	2295.95	12.16	69.91	1532216.80	27.49
Median	40.00	278390.54	51.88	14.79	1775.00	12.00	90.90	607161.29	20.82
SD	20.98	583777.25	17.51	19.80	1264.11	5.05	37.86	1880019.72	19.03
Minimum	11.00	19798.02	30.00	0.00	721.00	3.00	0.76	73990.98	4.18
Maximum	78.00	2345641.20	84.37	61.81	4970.00	22.00	100	6644499.16	69.75

5.10 Conclusions

In theory, the decentralization of management of the water sector and of the delivery service has the potential to improve water supply and extend water coverage in many parts of the world (Kirkpatrick, Parker, & Zhang, 2006). However, the results from the analysis of water service providers (WSPs) in Kenya as reported in this chapter do not support this assumption. Many of the WSPs are working below their capacity, which could be attributed to many factors including insufficient capital investments and a lack of trained personnel. According to the MWI (2008), most WSPs are too small to be economically viable and many of them are suffering under the burden of past liabilities including loans and electricity bills. Between 2006 and 2009, 40% of WSPs had their electricity cut off or had a warning from Kenya Power and Lighting Company (KPLC), on account of massive past electric bills still owing.

Another challenge for the WSPs relates to old and dilapidated water sector infrastructure. The WSPs, especially in urban areas, had been operating for a long time as local authorities under the government. The reforms required these firms to increase services in their area of jurisdiction without addressing the necessary expansion and rehabilitation of existing infrastructure. Many of these companies are also not profitable, and none of them (by 2010) had attracted private investments as initially anticipated. Therefore, they still rely on government grants and foreign donations which are not sufficient as seen in Table 4.10. The results also show that many WSPs are not on track to achieve the MDG targets as specified by the MLS (table 5.1). Table 5.9 shows that no WSPs in any category (large, medium, and small) are meeting the minimum requirements in terms of extending water coverage to 90% of the population in their respective jurisdictions or reducing UFW to 20 % levels. The table also suggests that thirteen (72%) of WSPs in the small category are performing below an unacceptable level by serving less than 30% of the population in their areas. This observation seems to suggest that small WSPs need to change their scale of operation by either increasing their investments in their systems in order to reach more customers, or clustering (amalgamating) with other smaller companies.

Table 5.9: Summary of WSPs' performance, as measured against MDG interim targets and against WASREB poor performance level, for four water provision parameters

WSPs	Water service coverage (%)	Unaccounted for Water (UFW)	Hours of water supply	Revenue collection efficiency
MDG targets	**>90%**	**<20%**	**Hours>16**	**>90%**
Large(15)	0	0	4	7
Medium(11)	0	0	4	7
Small(18)	0	0	5	8
WSPs operating below poor performance level				
Poor level	**<30%**	**>70%**	**Hours<16**	**<50**
Large (15)	6	8	0	1
Medium(11)	3	11	0	0
Small(18)	13	7	1	0

The investments are also required to cope with a rapidly growing population in the country. According to WASREB (2010), water access is highly skewed, with those living in rural and slum areas getting less and paying more. This calls for the need for government involvement in the supply of water, especially in rural areas which are not viable for private companies, and also to increase water subsidies and encourage low cost technologies such as water kiosks in slum areas. Reliance on tariffs as the sole source of revenue by WSPs is evidently not enough for the rehabilitation of old infrastructure and the expansion of access.

Most of the WSPs studied are incurring losses due to unaccounted for water (UFW). UFW, the disparity between the quantity of water produced for distribution by WSPs and the actual quantity of water billed, represents the difference between net production and consumption of water. This disparity may occur due to technical losses (e.g., leakages) and/or commercial losses (illegal connections, unbilled customers, wastage on un-metered customers) (WASREB, 2009). Table 5.9 shows that 53% of large WSPs, 100% of Medium WSPs, and 53% of medium WSPs, have not brought their UFW down to the 20% yearly level required to meet the MDG in 2015. Analysis by WASREB (2010) show that the average national consumption of water (water supplied by WSPs) per capita including UFW is 116 liters/capita/day, while consumption without UFW is 59 liters/capita/day. The amount of water lost therefore (57 liters/capita/day) is almost equivalent to the amount billed, meaning that on average the WSPs lose one half of their income through UFW (see figure 6.4 for further analysis). These figures also support findings that most WSPs in Africa incur losses of over 50% through UFW (Kirkpatrick, Parker, & Zhang, 2006).

Chapter Six: Major Findings and Contributions

6.1 Introduction

This chapter synthesizes the results and discusses the main findings of the study. It includes an evaluation of the extent to which the reforms have contributed to or hindered the progress towards water access as well as the achievement of the MDGs. In addition, the wider implications of the study are highlighted, and recommendations proffered for further actions regarding water reform policy and management.

6.2 "To investigate how global water targets and policies have influenced water institutional reforms (at a national scale) in Kenya from the colonial period to the year 2000, as well as the outcomes of those experiments": Major findings

The main findings of the study related to this objective can be summarized as follows: Traditional institutions in Kenya were severely disrupted when the British colonial administration imposed a dual system of governance based on land rights. The "Crown Lands" taken away from the natives and given to Europeans were governed by statutes based on English common law, while "Native Lands" set aside for the locals continued being governed by traditional institutions. Records show that the colonial government made several attempts to formalize and legislate the management of water in the country through, for example, the 1902, 1915, and 1929 *Crown land ordinance*, and the 1903 water rules. All these laws vested the ownership of water in the Queen of England who then delegated the daily management of water resource to the colonial governor. Section 75 of *Crown Land Ordinance* specifically denied any person right to spring, river, lake, or stream water except for domestic purposes, while section 145 prohibited damming of any spring or river without express permission of the colonial government (Nyanchaga & Ombogi, 2007).

The implication of this ordinance in terms of water access was enormous. First, the most fertile and well watered lands were confiscated from the local people who were then forced to move to marginal lands. These lands were either too dry and could not adequately support the communities with their livestock or in some cases too swampy and in need of draining to support agriculture. In the case of pastoralists, their migratory routes were curtailed and their watering points now fell under the domain of the Europeans. These communities were therefore forced to look for alternative sources of water. The policy shift gave the colonial government full control over the water resources of the country in order to address their imperial quest for agricultural expansion in the White Highlands. The colonial government mandated the department of public works, in collaboration with the newly formed Water Board, to drill wells and build water supply systems to increase supply mainly in the Crown Lands.

In many ways, therefore, the beginnings of systematic inequalities to water access in Kenya can be traced to the policies of the colonial government. It is important to clarify that even under traditional systems of water management, some people did not have access to water when ”access” is considered using modern standards. But people also had more options, including migration and the choice of the types of crops that they cultivated. Colonial policies foreclosed some options, deprived some groups of water by legislative fiat enforced by law, all coincident with the time when the population of the country also was growing rapidly. This, then, was the situation that the newly independent government of Kenya inherited.

6.2.1 Inadequate Remedies after Independence (1963-1999)

In 1974, the government enacted the first National Water Master Plan, with a goal of ensuring access to potable water at a reasonable distance (20 liters a day available at a source not more than one kilometer from the residence) to all Kenyans by 2000 (GoK, 2002). As in other sectors, water development during this period, emphasized political equality and social justice to correct inequalities created during the colonial period.

Achievements during the post-independence period are depicted in Figure 6.1. The graph shows a steady increase in access to drinking water between 1980 and 1990. This period coincides with the IDWSSD, and reflects the concerted effort from both the global and local communities to achieve universal access by the year 1990. This target was, of course, not achieved by this time, and the target year was shifted to 2000. During the IDWSSD, sanitation was not given the same emphasis as water supply, and therefore suffered drastic decline. From 1990-2000, however sanitation services were given a lot of emphasis by the World Health Organization and other UN agencies, reflected in the upward spike of sanitation access during this period. Although there was a steady increase in water access during this time, the target was not achieved mainly due to rapid population growth, lack of finances, government inefficiencies, poor cost recovery mechanisms by the water providers, and collapse of many of the systems due to poor management. The study show that by the year 2000, the target of ensuring water availability for all as contained in the National Water Master Plan of 1974 had not been reached; in fact, only half the 31 million population in 2000 had access to potable water, with only two thirds of the urban population having access to reliable water supplies (GoK, 2001). During this period, the self-help projects initiated by community groups also collapsed due to limited knowledge of operation, inadequate maintenance, and poor fiscal structure making them vulnerable to corruption and mismanagement. The water supply also suffered in the beginning of the year 2000 due to foreign financial freeze, meant to force the Kenyan government to implement Structural Adjustment Programs (SAPs) in the provision of social services, as well as address government corruption rampant at the time.

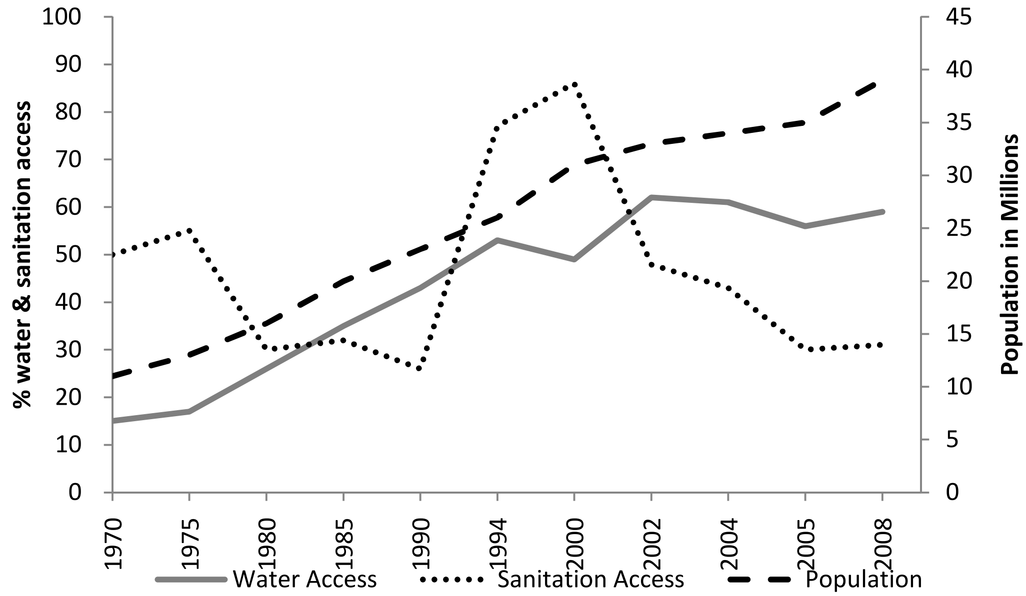


Figure 6.1: Water and sanitation Access between 1970 and 2008.

Data from WHO_UNICEF 2006

6.3 "To examine the institutional reforms that have taken place since the declaration of MDGs in the year 2000, in which the country seeks to reduce by 50% the population without access to safe water and sanitation coverage by 2015, and to assess how these reforms are facilitating or hindering the achievement of the MDG for water": Major findings

Analysis of water sector reforms shows that many achievements have been made at the policy and institutional levels. At the policy level, the government has formulated the National Water Services Strategy to serve as a blue-print for water service and distribution, and the National Water Management Strategy to serve as a blue-print for water management in the country. The policy change was implemented by enacting a new legal framework *(Water Act of 2002)* to replace the old water act chapter 372. The study found that the major problem retarding potential improvement in water access in Kenya relates to the rate at which water projects geared towards achieving MDGs are being implemented. For example, between 2005 and 2009, only 30% of wells, 27% of boreholes, 16% of storage tanks, and 9% of latrines were completed. The slow pace has been attributed to many factors, including misappropriation or insufficient funds, the post-election disturbances of 2007, and political interference from the national government level. The Kibora gravity scheme with 15 km of distribution lines in Trans-Nzoia district was abandoned due to the 2007 post-election clashes. Other projects affected by post-election clashes and still abandoned include the Samarach borehole project in west Pokot district, the Koibatek project which includes borehole and water kiosks, and the Ketecho borehole project in Koibatek district.

Many projects within the ministry of water have been affected by allegations of corruption. The minister of water and Irrigation, Mrs. Charity Ngilu, has been accused of favoritism. The Daily Nation (November, 6, 2010), indicate that out of the 408 boreholes drilled under her tenure, 126 are in her home area. The minister has also been accused of awarding tenders to the same consultants even before previously awarded projects, are completed, contrary to regulations. She is also accused of nepotism, in the sense that most of the consultants are her relatives. The assistant minister, Mr. Kiunjiri, has also been accused of colluding with consultants to inflate the cost of constructing dams. Ongoing corruption also has led to funding freezes or restrictions from international donors.

A significant problem in the water sector reforms is the over-reliance on donor funding. Between 2005 and 2009, donor funding accounted for 77% of all expenditure in the water sector. This source of funding is subject to fluctuations, and stringent conditions. For example, in the late 1980s and early 1990s, donor funds were frozen on several occasions because the Kenyan government refused to implement SAPs imposed by the donor community. As a consequence, the Kenyan government was unable to operate or maintain water supply projects efficiently during this period. Funds have also been frozen because of corruption within the Kenyan government. Institutions in the water sector including WSPs are operating at big losses, and therefore cannot attract private investment to offset donor funding gap. Over-reliance on donor support in many cases has led to transfer of inappropriate and incompatible technologies. Different countries prefer different technologies for water supply and sewerage development. This presented problems in cases of breakages in equipment and physical infrastructure, as spare parts had to be sought from abroad.

6.4 "To quantitatively analyze the productivity and efficiencies of Water Service Providers (WSPs) in Kenya, and then to evaluate the extent to which these WSPs are meeting the stipulated minimum level benchmarks recommended by the Water Services Regulatory Boards (WASREBs), and making progress towards meeting the MDGs for water": Major findings

None of the 44 WSPs analyzed (large, medium, and small) are meeting the minimum requirements of extending water coverage to 90% of the population in their respective jurisdictions or reducing UFW to 20 % levels. The study shows that thirteen (72%) of WSPs in the small category are performing below an unacceptable level by serving less than 30% of the population in their areas.

The study identified several factors contributing to the underperformance of the WSPs. Many of them are working below their capacity, which could be attributed to many factors including insufficient capital investments, and lack of trained personnel. Most of WSPs are too small to be economically viable and many of them are suffering under the burden of past liabilities including loans and electricity bills. Between 2006 and 2009, 40% of WSPs had their electricity cut off or had a warning from Kenya Power and Lighting Company (KPLC), on account of massive past electric bills. Another challenge for the WSPs relates to old and dilapidated water sector infrastructure leading to high UFW. Unaccounted For Water (UFW) is a major problem for WSPs. Analysis show that 51% of the WSPs have water loses above 50%. WSPs in the large category lost an average of 73% of water they produced through UFW in 2009. The average national consumption of water per capita including UFW is 116 liters /capita/day, while consumption without UFW is 59 l/c/d. The amount of water lost therefore (57 l/c/d) is almost equivalent to the amount billed. This means that on average, the WSPs lose 50% of their income through UFW. There is therefore need for greater investment in the supporting infrastructure and this has not happened. As mentioned earlier, the networks for most of the companies were laid down during the colonial period and are antiquated, and in need of extensive maintenance. This should include metering of water distribution to help detect and monitor water supply. The WSPs, especially in urban areas, had been operating for a long time as local authorities under the government. The reforms required these firms to increase services in their area of jurisdiction without addressing the necessary expansion and rehabilitation of existing infrastructure. Many of these companies are also not profitable, and none of them (by 2010) had attracted private investments as initially anticipated. Therefore, they still rely on government grants and foreign donations which are not sufficient. This observation suggests that small WSPs need to change their scale of operation by either increasing investments in their systems in order to reach more customers, or clustering (amalgamating) with other smaller companies.

Some of the problems facing WSPs could be mitigated through benchmarking process. The study provides possible benchmark peers for large, medium, and small WSPs. In the large WSPs category for example, the Gusii WSP is the poorest in its category, and has a choice of four WSPs to emulate: Othaya, Eldoret, Nakuru, and Nakuru rural. These WSPs are considered relatively efficient and serve as a benchmark for more than half of the WSPs in their category. It should be noted, however, that even the benchmark firms have not met the minimum interim yearly requirements (as specified in Table 5.1) needed to achieve the MDG in 2015. Medium-sized WSPs, seem to be performing better, with only Muranga and Kericho having four and three benchmark peers respectively. The small WSPs are doing poorly, with 13 out of 18 WSPs having benchmark peers. In this category, Embu, Lamu, Mt. Elgon, and Muthambi are considered relatively efficient.

6.5 Main Research Contributions

The dissertation has contributed to an understanding of the context and dynamics of water sector reforms and the ways in which these reforms have influenced actual water access. Prior to this study, there had been no comprehensive analysis and evaluation of water reforms in Kenya with respect to past and present water access goals and targets.

The study has shown that, while the 2000 reforms have resulted in major gains in policy reforms, significant improvement in water access will not be achieved without addressing the systematic inequalities of water access caused by land alienation during the colonial rule. After independence, most of the land owned by the Europeans was not returned to the natives, but rather bought by the rich or converted to game reserves. In this case, the land tenure system that broadly disenfranchised the local population before independence continues to date. The study found that water management and provision during the colonial period essentially displaced the traditional institutions involved in looking after water resources. In their place were established a series of reforms, the two main effects of which were to; broadly disenfranchise the native population in respect of water access and to utilize water as a driver of imperialism by expanding agricultural production of exotic crops. The water reform Act of 2002 sadly turns a blind eye to this critical fact.

The study also uncovered that by pegging its initiatives on global targets and foreign aid, Kenya has changed its policies and institutions to reflect the global trend several times. This has led to lack of continuity in the policy process in the country. For example, during the IDWSSD (1980-1990), the primary global focus was on universal water access to reduce global diseases related to water. The WHO was therefore a primary UN body in charge of this mission. In Kenya, despite the Ministry of Water and Irrigation being in charge of water resources, the global initiative was under the auspices of the Ministry of Health. All resources were therefore focused on this ministry but at the end of this initiative, the target was not met. The MDG initiative adopted after that changed the focus from health to poverty alleviation. The change in policy this time fell under the Ministry of Water and Irrigation and Ministry of Planning. Based on this study, indications show that by the end of 2015, the target will not be achieved necessitating another policy review. At this point, the government should look at building on the success already achieved by strengthening the available institutions, rather than changing the focus altogether as has happened before. Figure 6.2 summarizes water sector reform trends and policy change from 1960 to 2010.

Regarding commercialization of water and sewerage services, the study found that the WSPs created to replace the government agencies in the provision of water services are not efficient and productive enough to meet the MDG The study suggests that these inefficiencies could be mitigated through benchmarking.

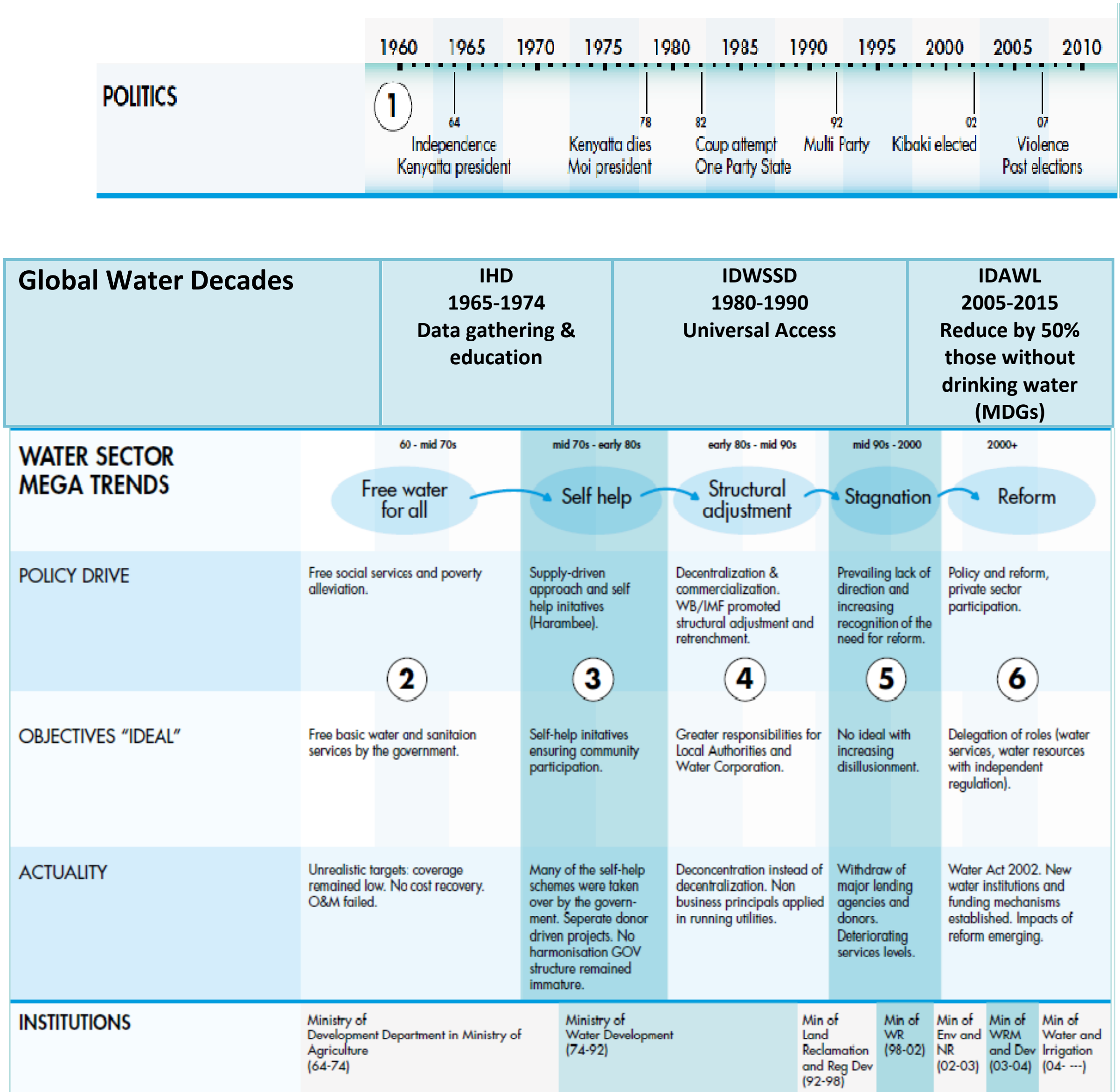


Figure 6.2 Water sector reform trends from 1960 to 2010 (adapted from Danida & Sida 2010).

6.6 Implications and Recommendations

This study has examined the evolution of water reforms in Kenya in order to untangle the socio-political and economic dynamics responsible for the success or failure of these reforms. The results of the analysis should enable barriers to the improvement of access to water to be identified, and ways forward to be elucidated. In addition, the findings should allow best practices to be identified that may be valuable to other countries or regions with similar socio-political situations (primarily the African nations), or pitfalls that should be avoided in formulating, or implementing regional-scale water reform policies.

6.6.1 Implications and Recommendations for current and future water reform policies and sector institutions

The major goal of the water reforms was that these water sector institutions would be economically sustainable; however, this research has shown that all the institutions are underfunded. In this case, the institutions are forced to rely on the government through the MWI for funding. The government is therefore still in the business of policy as well as regulation because it controls the purse, and in many cases dictate how the money is spent. Many incidences of corruption, especially the misappropriation of funds, are the direct result of the government providing the leading role in funding decisions. To achieve the objective of policy and regulation separation, the government should confine itself to the role of policy maker and channel all the funding through the WSTF.

Funding channels have also compromised the separation of duties. For example, the WSTF funds WRUAs through the WRMA, which is a regulation institution. Despite the fact that the WRMA is in charge of regulation, it is also in charge of helping the WRUAs develop catchment plans in order to secure funds. In the process, WRMA finds itself doubling in regulation, policy formulation, and also implementation. In the water service sector, WSBs are supposed to issue permits to WSPs and regulate their functions. But in a case where no WSP is available, the WSB or the government can perform the water delivery functions, making it both a regulator and policy formulator. Given all these aforementioned overlapping functions, additional reorganization may need to take place to ensure full separation is made between policy, regulation, and management/implementation in the water sector institutional structure.

Another problem in the sector relates to harmonizing the works of many institutions dealing with water. For example the reform does not address the harmonization of irrigation policy, flood policy, drought policy, environment policy, and public health policy. In this case, different ministries are still pursuing parallel functions relating to water. This problem needs to be addressed by further restructuring of institutional functions. Furthermore, the study found that while the concept of IWRM requires some form of integration of institutions that deal with water resources to avoid conflict and duplication of services, many institutions and ministries deal with water issues, yet there is no clear policy outlining the intergration or coodination of their functions. Such ministries include agriculture, public health, environment, fisheries, and local government. The success of IWRM in Kenya and Africa at large will depend on harmonized policies in these ministries.

Perhaps the greatest challenge in executing IWRM in Kenya relates to the financing of the whole process from the national level to the basin level. The study shows that while the relevant policies and institutions have been set up, the institutions lack funds to suport the planned activities and projects. This has forced the government to rely, as before, on foreign donors for funds. This problem is evident, for example, at the basin level where fewer than 20% of planed projects have been completed at the required time. The government should have carried out pilot programs on a smaller scale and channeled funds to those regions. This would have enabled the government to fine tune the concept and adjust it to the local situation, and allow it to serve as a reference for implementation in other parts of the country.

In the long term, the government should wean itself off excessive reliance on foreign funding while weeding itself of corruption. Foreign funding, as discussed, has many conditions attached to it and therefore serves as a vehicle for policy change.

6.7 Further Research

This research has identified a number of areas in which further research is needed. For example, (1) what is the influence of foreign aid on policy implementation at the basin level? (2) What is the contribution of stakeholder participation in extending water access, and what conditions are necessary for effective stakeholder participation in Kenya? (3) How could WSPs be made more efficient and how well does benchmaking work in helping poorly performing WSPs?

6.8 Prospect: The Future of Water Access in Kenya

The future of water access in Kenya will remain dismal if current problems undermining progress, as discussed in this study, are not addressed. In addition, the country should adopt a comprehensive approach in which the country is steered away from over-reliance on a natural resource economy. This would ease the stress put on water by agriculture and agro-based industries. Such an approach would include diversification of economic activities in the ASAL region to give the people in these regions alternative sources of income and thereby avoiding overstocking. The country should also seek to develop other sources of energy and reduce the extreme reliance on hydro-electric power which currently stands at 72%. Also on the demand side, Kenya should pursue policies aimed at reducing the rate of population growth through, for example, education and family planning initiatives. On the supply side, real improvements in water access will not arrive until the performance of WSPs can be improved. Unfortunately, this is unlikely to happen until more significant investment is made into the operating environments and infrastructural assets of these companies.

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APPENDIX ONE: QUESTIONNAIRE SURVEY

Daniel Sambu
University of Oklahoma

Integrated Water Resource Management in Kenya: Progress in water reforms and water access efforts

Dear Survey Respondent

This survey tries to evaluate the progress Kenya has made in implementing Integrated Water Resource Management (IWRM) and the extent to which this process has facilitated or hindered improved water resource management in the country and the achievement of the Millennium Development Goal (MDG) related to water. The research forms part of my dissertation and for this reason, I request that you take a few minutes to help me complete the questionnaire. Your collaboration in this effort is highly appreciated. You may attach any information if space is limited

Last Name_______________________________

First Name _______________________________

Designation________________________________

A: Basic Data

1. What is the name of the Water service Board in your Area? ________________________

2. What is the potential water availability within your WSB? _________________________

3. Please provide information about WSPs in your area on the table below

	WSP	Water production m^3	Population	Population served	% access to Drinking water	% Access to Sanitation
1						
2						
3						
4						
5						
6						
7						

4. What are the main characteristics of IWRM within the sub region?

- ◯ Oriented towards supply management
- ◯ Oriented towards demand management
- ◯ Oriented towards both

5. Please indicate the number of water projects in each WSB between 2005 and 2009

Number of water projects between 2005 and 2009							
	WSB	Borehole	Wells	Storage tanks	Water Kiosks	Spring protection	other
1							
2							
3							
4							
5							
6							
7							

B. Institutions

6 (a) is there a central council (agency) responsible for coordination of decisions and actions among various users of water (municipalities, industries, farmers etc)

- Yes
- No

b. If yes, What is the name of the agency ____________________________

7. What are the major obstacles facing this agency (Rate from the most severe to the least)

8. Who is responsible for financing water projects?

9. What are the criteria for selecting and financing a water project?

10. How many projects have been financed in your WSB?

11. How many projects have been completed?

12. If some projects have not been completed, what are some of the problems causing the slow progress? (Rate from the most severe to the least)

C. Legislation

13. What are the institutions responsible for initiating **laws** and setting water **standards** and **regulation?**

14. Are the national laws appropriate for developing and implementing the water plans at the region?

- ○ To a high extent
- ○ To a certain extent
- ○ Not at all

15. What should be done to make the national laws more effective at the local level?

16. What are the existing water rights in the basin (e.g. concessions, permanent rights, short term rights)?

16. Who is responsible for

Duty	Body Responsible
Awarding water rights	
Water allocation	
Modeling water availability	
Monitoring water quality	
collecting water tariffs	

D. Stakeholders

17. Does your sub-basin allow for

Activity	Yes	No	How
Stakeholder Representation			
Gender balanced decisions			
Participatory decision making			
Fair and appropriate charges to users of water			
Capacity building for stakeholders			

18. On what basis are stakeholders chosen (Rank in order of preference 1 being the best and 5 being the least

- [ ] Having great information regarding water issues
- [ ] Involvement in water utilization
- [ ] Involvement in water supply and development
- [ ] Having significant influence on water users
- [ ] Other specify ______

Save and send as attachment to dsambu@gmail.com

APPENDIX TWO:

The University of Oklahoma

OFFICE FOR HUMAN RESEARCH PARTICIPANT PROTECTION

IRB Number: 12680
Category: 2
Approval Date: August 28, 2009

August 31, 2009

Daniel Sambu
Geography
100 E. Boyd Street, SEC 684
Norman, OK 73019

Dear Mr. Sambu:

RE: The Status and Progress of Millennium Development Goals (MDG's) and Water Reforms in Kenya

On behalf of the Institutional Review Board (IRB), I have reviewed the above-referenced research project and determined that it meets the criteria in 45 CFR 46, as amended, for exemption from IRB review. You may proceed with the research as proposed. Please note that any changes in the protocol will need to be submitted to the IRB for review as changes could affect this determination of exempt status. Also note that you should notify the IRB office when this project is completed, so we can remove it from our files.

If you have any questions or need additional information, please do not hesitate to call the IRB office at (405) 325-8110 or send an email to irb@ou.edu.

Cordially,

Donald Baker, Ph.D.
Vice Chair, Institutional Review Board