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Acrimony

AEZ	Agro-Ecological Zones
ASAL	Arid and Semi-Arid Lands
BWS	Blue Water Saving
CAAC	Catchment Areas Advisory Committees
CDM	Clean Development Mechanisms
CMS	Catchment Management Strategy
CWMS	Community Water Management Systems
EMCA	Environmental Management Coordination Act
ENSO	El Niño Southern Oscillation
ES	Ecological/Environmental Services
EWS	Early Warning Systems
FGD	Focus Group Discussion
GoK	Government of Kenya
GWC	Green Water Credits
GWS	Green Water Saving
LIF	Legal and Institutional Framework
LSCA	Lower Sub-Catchment Area
PAE	Performance Assessment and Evaluation
PES	Payments for Ecological/Environmental Services
PPF	Production Possibility Frontiers
PPP	Public-Private Partnerships
PWS	Payment for Watershed Services
REDD+	Reducing Emissions from Deforestation and forest Degradation
SCMP	Sub-Catchment Management Plans
SPSS	Statistical Package for Social Sciences
SWC	Soil and Water Conservation
USCA	Upper Sub-Catchment Area
WAB	Water Appeal Boards
WASREB	Water Services Regulatory Board
WRMA	Water Resources Management Authority
WRMD	Water Resource Management and Development
WRUA	Water Resource Users' Associations
WSB	Water Services' Boards
WSP	Water Service Providers

2. Performance Assessment and Evaluation of Community Participation in Water Sector Governance

The case of Ngaciuma-Kinyaritha catchment, Mount Kenya Region

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Introduction

The Republic of Kenya initiated key reforms in 1999 in its water sector governance. These reforms culminated with the release of the Water Act 2002, which has been amended to comply with the devolved system enshrined in the Constitution of Kenya 2010. The Water Act 2002 instituted a separation between Water Service Providers (WSPs) and Water Resource Users' Associations (WRUA). In compliance with the new legislation, Ngaciuma-Kinyaritha stakeholders created a WRUA in that catchment in 2006, amid many Community Water Management Systems (CWMSs). The latter are not legally recognised for managing water resources or for supplying water services.

Should these CWMSs seek registration to qualify as WSPs? This is technically difficult for most "self-help" groups, and this study sought to assess the performance of the newly established key institutions among the CWMSs in Ngaciuma-Kinyaritha Catchment. To isolate the contribution of CWMSs to domestic water security a Performance Assessment and Evaluation (PAE) was conducted based on household survey data from 165 farmers and 36 in-depth interviews.

The findings reveal that Kenya can be credited with having succeeded in initiating and implementing a participatory water governance system, despite

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various financial and investment challenges. Moreover, though not legally recognised, CWMSs have achieved almost a third of the targets of the water sector reforms in Ngaciuma-Kinyaritha Catchment, just like the registered WSPs and WRUAs. They need to be integrated into the new Water Act, which hopefully will be enacted in 2015. The latter has undergone a very long revision since 2012, owing to contention over the transfer of powers on water supply and water resources (Cap. 371 and 372) and other political interferences.

Purpose of the study

World water resources will be major casualties of global warming. Kundzewicz (2007) noted that, "There are three categories of water stress that would be exacerbated by climate change: (i) Too little; (ii) Too much; and (iii) Too dirty." Though Hulme et al. (2001) predicted increased precipitation in most Arid and Semi-Arid Lands (ASALs) of Kenya during dry periods, these and other humid areas will experience lower precipitation during almost the whole year. Therefore, visionary policies and legislation are needed to promote water security through local investment in water and land conservation (Huggins 2002). Community involvement in water resource management was the core objective of the water sector reforms initiated in Kenya in 1999. However, conservation of wetlands as a source of water and income generating activities there from emanating were not given prominence dispite Kenya being a signatory of the ramsar convention. These would have provided an incentive for sustainable local wetlands conservation and thus community water security (Macharia et al. 2010) To integrate local communities into such participatory water governance, the new Water Act (2002) instituted WRUAs in all the catchments amid many Water Service Providers (WSPs) by ignoring the traditional role of existing Community Water Management Systems (CWMSs) (Mathenge et al. 2014). Thenceforward, the Water Resource Management Authority (WRMA) could not integrate these CWMSs into its institutional framework in order to guide the development, supply, utilisation and conservation of water resources at the local level. Should these CWMSs therefore seek registration to qualify as WSPs? In legal terms the answer is a simple "yes," but registration is technically difficult for most "self-help" groups operating under customary law, which gave them all the mandates of the newly created WRUAs and WSPs. This study sought to uncover the implications of a ban on such traditional institutions on water security. A comparative assessment of the performance of CWMSs operating in Ngaciuma-Kinyaritha Catchment vis-à-vis the newly created WRUA and WSP was aimed at isolating their respective contributions to domestic water security in the Mount Kenya Region.

Literature review

Climate Impact on the Rural Economy of Kenya

Climatic water related hazards are predicted to escalate in regions where forests and wetlands have been depleted (Pachauri 2004; Ngonzo et al. 2010). The latter are known to absorb excess water during floods and soften the effects of droughts. Hence, the 2007/2008 Human Development Report (HDR) mentioned five interactive transmission mechanisms of climate impacts on the rural economy: (1) collapse of ecosystems; (2) increased coastal flooding and extreme weather events; (3) heightened water insecurity; (4) reduced agricultural productivity; and (5) increased health risks. The report concludes: "While the processes are already apparent in many countries, breaching the 2°C threshold would mark a qualitative shift: it would mark a transition to far greater ecological, social and economic damage" (UNDP 2007: P. 30).

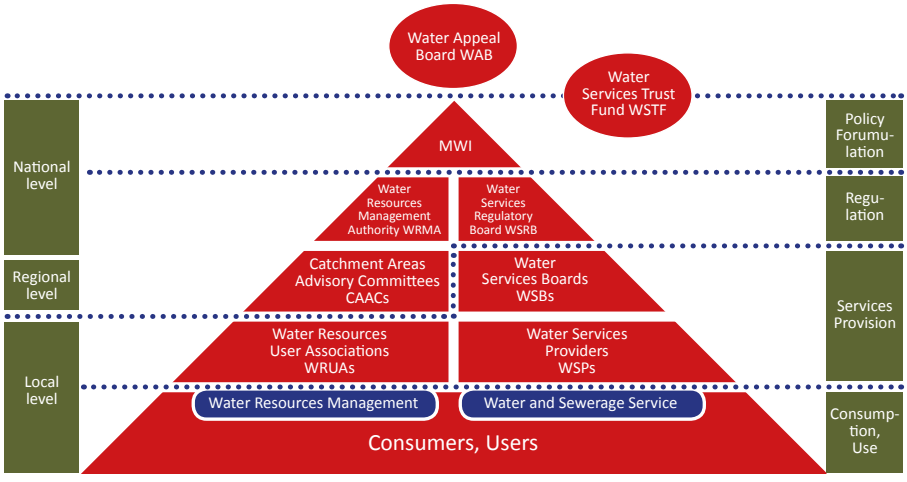
An ecological disaster in the Kenyan rural economy may be explained in terms of extreme water deficiency or low soil moisture in farmlands, which lead to excessive water stress or desiccation of crops and plants, soil loss and mass movements, and massive loss of natural habitats (Brown 2001; UNEP 2009). The social disaster may be attributed to the effect of the El Niño Southern Oscillation (ENSO) associated with worsening vulnerability to drought and dry spells as well as other related extreme events (Downing 2003; Jaetzold et al. 2007). Finally, an economic disaster is generally associated with externalities emanating from environmental changes (Luwesi 2010). Consequently, legal and policy responses are key in achieving adaptation to and mitigation of water disasters in order to ensure water and food security in the course of climate change (Huggins 2002; Van Koppen 2007).

Legal and Policy Responses to Water Disasters in Kenya

Kenya has undergone several reforms to the governance of its water sector. Ngigi and Macharia (2007) report that from 1963 (independence) to 1997, the reforms targeted improvement of water quality and quantity through adequate financing mechanisms (GOK 1965). This was reiterated in the "Water for all by 2000" slogan in the 1974 National Water Master Plan (NWMP), which led to establishment of a national water development corporation in 1988 and a National Water Master Plan 2012 in 1992 (GOK 1999).

The first guidelines for community participation appeared in 1997, when the government invited the private sector to participate in a decentralised form of water governance (K'akumu 2008). These guidelines were formally released in 1999 as the National Policy on Water Resource Management and Development (GOK 1999). They were enacted as laws under the Water Act 2002 (GOK 2002) (Figure 1).

Figure 1: Legal framework of the Water Act 2002



Source: GOK (2002)

Pursuant to the implementation of the Water Act 2002, the WRMA and Water Services Regulatory Board (WASREB) were established in 2005, followed by a National Water Resources Management Strategy (2007–09) and its integration into the 2007 Kenyan development blueprint, Kenya Vision 2030. In 2012, a new bill was introduced into parliament to align the provisions of the Water Act 2002 with the devolution enshrined in the Constitution of Kenya 2010 (GOK 2010; 2014). This gave rise to the development of the National Water Master Plan 2030 (JICA and GoK 2013).

Community Involvement in Water Resources Management

The global community recognises the right of both men and women to participate in development projects. In fact, the Rio Declaration on Environment and Development (UNSD 1992) stated: "environmental issues are best handled with the participation of all concerned citizens, at the relevant level …" (Principle 10). One of the four principles put forward at the Dublin Water Conference in 1992 was that "Water development and management should be based upon a participatory approach …" (Förch et al. 2005). These principles have long been stressed and widely accepted by international, national and local levels of government, even if they have not been implemented by all governments (Crow and Sultana 2002).

Nishimoto (2003) reports that a World Bank review strongly encouraged women's participation in 121 rural water supply projects, which were found to be effective and sustainable. Maharaj et al. (1999) reveals that a government programme in Malawi was at risk of collapse when male-dominated committees were collecting fees. A change of regulations that assigned 60 per cent women

and 40 per cent men to committees led to improved management of the programme. Similarly, the success of the Philippines Communal Irrigation Project was attributed to the integration of women into project operations (Nishimoto 2003). As in Malawi, the involvement of women increased payment of fees, as women controlled household finances.

Hence, in the "World Water Vision" Cosgrove and Rijsberman (2000) cite public participation in the management and conservation of water resources as a "real revolution." But, this will only come true if all stakeholders are empowered to manage their own resources. Yet, community participation in the implementation of the Kenyan Water Act 2002 does not include communal "Self-Help Groups," which are acknowledged as managing the catchment area while providing water services to all (Mathenge et al. 2013). Instead, the law delegates water catchment conservation to the WRUAs registered by WRMA, while the provision of water, sanitation and sewage services is the sole responsibility of WSPs legally licensed by the WASREB (Were et al. 2006).

The CWMSs existing where such legal institutions do not operate are therefore challenged in discharging their communal mandate of guiding the development, supply, utilisation and conservation of local water resources. Should these CWMSs seek registration to qualify as WSPs and/or WRUAs? This study will shed light on their contribution to water security under changing legal environments in Ngaciuma-Kinyaritha.

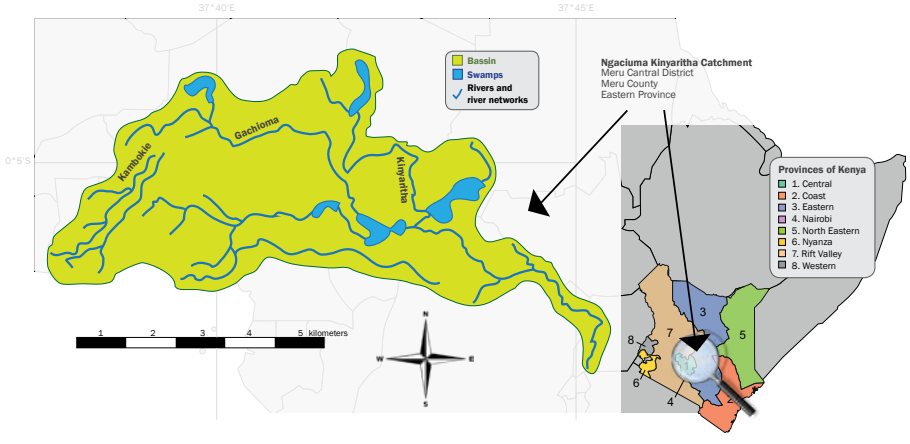
Methodology

Geographical Setting of the Study Area

Ngaciuma-Kinyaritha is a sub-catchment of the Tana River emanating from Mount Kenya. It covers an area of 167 km^2, with an estimated population of about 65,000 and a density of 390 persons/km^2 (KNBS 2010). The catchment is bound by longitudes 37.5° E and 37.75 ° E, and latitudes 0.04 ° N and 0.15 ° N (Figure 2).

The catchment spans three coffee agro-ecological zones (AEZ), namely Upper Midland AEZ 1 (UM 1), the coffee-tea zone; Upper Midland AEZ 2 (UM 2), the main coffee zone; and Upper Midland AEZ 3 (UM 3), the marginal coffee zone (Jaetzold et al. 2007). Most of the soils are basaltic volcanic rock, except in the forested parts, with altitudes ranging from 1,120 m to 2,600 m. They are geologically young soils, thus poorly consolidated and susceptible to erosion and mass movement, as well as to high infiltration and seepage rates, especially on hillslopes (Förch et al. 2008). This justifies the presence of CWMSs to manage the little surface drainage at source, including Lake Nkunga crater, with its three springs and a sub-surface outlet joining Ngaciuma and Kinyaritha streams.

Figure 2: Map of Ngaciuma-Kinyaritha Catchment



Source: Alufa (2010)

Sampling Strategy and Sample Size

Ngaciuma-kinyaritha Catchment was purposely selected because it was one of the pilot catchments designated by WRMA for WRUA formation in 2006. A stratified random sampling was used to divide the catchment into three different hydro-ecological zones, Ngaciuma, Kinyaritha Minor and Kinyaritha Major. In total, 177 households were randomly selected at 5 % significance level, 5 % estimate precision and 10 % true population proportion. These were affiliates of 32 CWMSs and 1 WRUA.

Data Collection

Data used in this study mainly encompass socioeconomic information collected during a household survey (using questionnaires), in-depth interviews (involving 36 local administration officers) and a Focus Group Discussion (FGD) with eight key informants from the 32 CWMSs. A documentary review made possible the gathering of secondary data on water resources and demand within the six basins of Kenya and the three major nodes of the Ngaciuma-Kinyaritha River.

Data Analysis and Interpretation of Results

Data collected were inputted, pre-processed and analysed using SPSS and MS Excel spreadsheets. The results relating to the performance of WRMA and WASREB were retrieved from official government and private documents. However, the socioeconomic factors emphasised during the survey, interviews and FGD were subjected to a robust Performance Assessment and Evaluation (PAE) involving both qualitative and quantitative techniques along with a triangulation of data and methods (Furubo 2009).

The only qualitative technique used in the robust PAE involved pattern or content analysis. The remaining part of the analysis used quantitative techniques supported by a scorecard of key actors involved in the study, namely a WSP (MEWASS), a WRUA (NGAKINYA WRUA) and 32 anonymous CWMSs. Utility ratios on the efficiency and effectiveness of each of the above institutions were derived by comparing descriptive statistics with the targets of the NGAKINYA WRUA SCMP 2007–2010 (Rogers 2005; Kazbekov et al. 2009). These results were presented in tables and in a web chart to shed light on the contribution of local CWMSs to ensuring domestic water security among the WRUAs and WSPs operating in the Ngaciuma-Kinyaritha Catchment.

Results and discussion

Overall Performance of the 2002 Water Sector Reforms

Water Resources Management: The Government of Kenya (GoK) through WRMA may be credited with reaching a landmark in its water resource management targets. WRMA (2010) reports that GoK established six WRMA regional offices in 2005 in order to tackle inappropriate farming practices leading to land degradation, water crises and resource conflicts among upstream and downstream users. These encompassed: (a) Lake Victoria North Catchment Area (LVNCA), covering 18,374 km^2; (b) Lake Victoria South Catchment Area (LVSCA): 31,734 km^2; (c) Rift Valley Catchment Area (RVCA): 130,452 km^2; (d) Athi Catchment Area (ACA): 58,639 km^2; (e) Tana Catchment Area (TCA): 126,026 km^2; and, (f) Ewaso Ng'iro North Catchment Area (ENNCA), covering 210,226 km^2.

Besides the operationalisation of WRMA, Catchment Areas Advisory Committees (CAACs) were also put in place to advise WRMA in accomplishing its mandate. This led to the creation of the first WRUAs in the Tana Catchment (Bwathonaro and Ngaciuma-kinyaritha sub-catchments) in 2006–07. Also, the first Sub-Catchment Management Plans (SCMPs) were developed in each pilot catchment area during the same period. By 2009, each of the six WRMA regional offices had developed its Catchment Management Strategy (CMS), and over US$ 1,800,000 (KES 126,104,300) had been collected from water users. This development was explained by the increased number of WRUAs across the country to about 292 in 2010, 80 being mature and having SCMPs. Besides, a reduction by over 30 % of illegal water abstractions was recorded in the upper sub-catchments, while in the middle and lower sub-catchments a more than 70 % decrease was recorded. Finally, about 21.9 % of large water users and 78.1 % of small users were complying with water rules and regularly paying their water fees. Only seven prosecutions were initiated by the Water Appeal Boards (WABs) and parties complied with the decisions.

However, new developments are afoot in the Kenyan water sector ahead of

Table 1: Projected water balance in Kenya (millions of m^3)

	2010			2030			2050		
Catchment Area	Water Resources (a)	Water Demand (b)	(b)(a)	Water Resources (c)	Water Demand (d)	(d)(c)	Water Resources (e)	Water Demand (f)	(f)(e)
LVNCA	4,742	228	5 %	5,077	1,337	26 %	5,595	1,573	28 %
LVSCA	4,975	385	8 %	5,937	2,953	50 %	7,195	3,251	45 %
RVCA	2,559	357	14 %	3,147	1,494	47 %	3,903	1,689	43 %
ACA	1,503	1,145	76 %	1,634	4,586	281 %	2,043	5,202	255 %
TCA	6,533	891	14 %	7,828	8,241	105 %	7,891	8,476	107 %
ENNCA	2,251	212	9 %	3,011	2,857	95 %	1,810	2,950	163 %
Total	22,564	3,218	14 %	26,634	21,468	81 %	28,437	23,141	81 %

Sources: JICA and GoK (2013)

the implementation of the devolution enshrined in the Constitution of Kenya 2010. The proposed Water Act 2014 suggests that WRMA will be upgraded to the status of Water Resources Regulatory Agency at the national level, and "Basin Water Regulatory Boards" at the basin level (under section 9); and CAACs will become "Basin Water Resources Committees" (under section 23) (GOK 2014). The new legislation has also proposed the creation of "new agencies, such as 'Water Works Development Board' and 'National Water Harvesting and Storage Authority'" (WaterCap 2014).

In line with the constitution, the national government will have to conserve catchment areas, develop water service infrastructures and monitor water service quality. Local governments will have to implement national policies at the county level to supplement infrastructure development for resource exploitation (GOK 2014). However, there are still gaps with regard to: (1) the capacity of institutions to manage water, sewage and drainage services as well as wastewater reclamation and disaster management at county level; and (2) the separation of regulation and implementation functions among the new bodies. These challenges need to be addressed as fast as possible to mitigate the deficits in water resources projected by 2030 in ACA, TCA and ENNCA (Table 1). Nonetheless, increased water resources and demand are foreseen in each basin, but with a reverse trend for water resources in 2050 in the ASALs, especially in ENNCA. Higher water demands of more than 40 % are predicted over water resources in ACA and Ewaso Ng'iro North Catchment Area. This will be driven by demand for irrigation water as proposed by the Kenya Vision 2030 (Table 2).

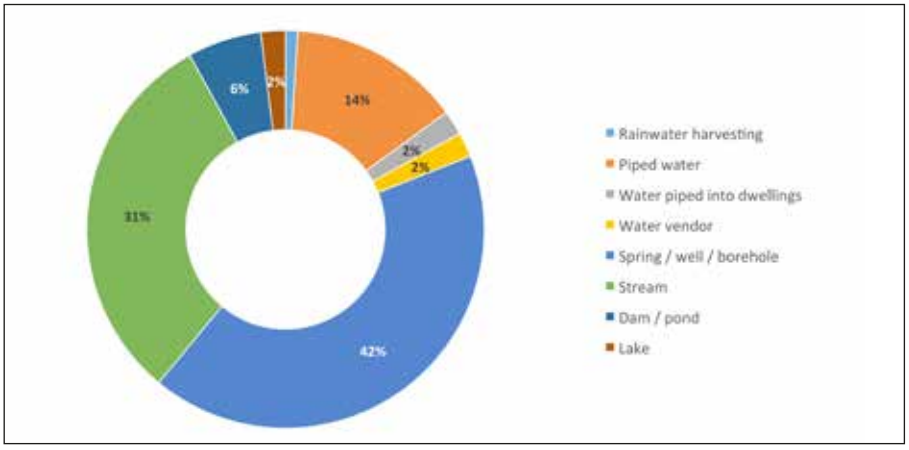
Water Services Provision: According to the Kenya national census of 2009, only 14 % of households in rural areas reported having access to tap water, while a majority fetched water from springs, wells and boreholes (42 %), streams (31 %) and dams and ponds (6 %) (Figure 3).

Table 2: Projected water demand by sub-sector (millions of m^3)

Subsector	Year 2010 (a)	Year 2030 (b)	(b)(a) (%)	Year 2050 (c)	(c)(a) (%)
Domestic	1,186	2,561	216	3,657	308
Industrial	125	280	224	613	490
Irrigation	1,602	18,048	1,127	18,048	1,127
Livestock	255	497	195	710	278
Wildlife	8	8	100	8	100
Fisheries	42	74	176	105	250
Total	3,218	21,468	667	23,141	719

Sources: JICA and GoK (2013)

Figure 3: Water service accessibility in rural area



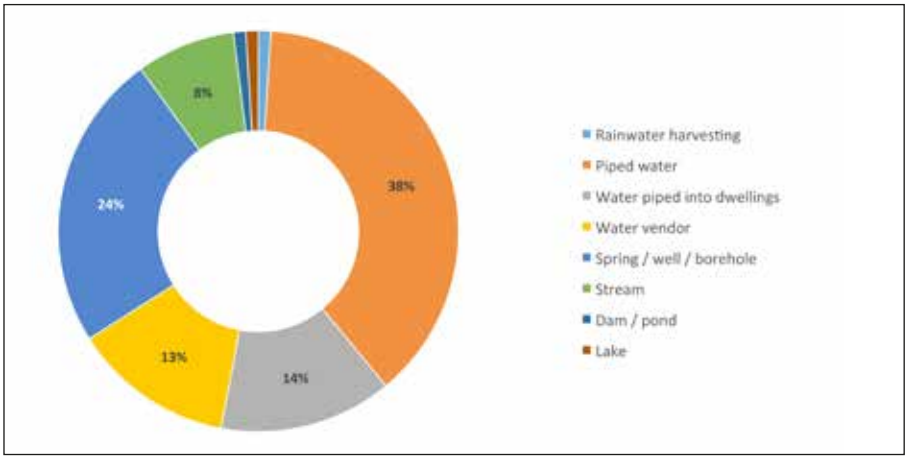
Source: KNBS 2010

However, 38 % accessed tap water in urban settings, and 14 % even had water connections to their homes. Only 24 % had to use springs, wells and boreholes, 13 % water vendors and 8 % streams (Figure 4).

This situation called for the creation of Water Services Regulatory Board to license Water Services' Boards (WSBs). The latter have the mandate of developing water infrastructure in each region served by WASREB, and award permits to WSPs in major cities and to rural areas under WSB control. Strategic actions adopted by WASREB for financing water infrastructure included: (i) tariffs, fees and fines to cover transaction costs for Operations and Maintenance (O&M); (ii) governmental Medium Term Expenditure Framework (MTEF) to collect taxes from domestic taxpayers to finance water infrastructure development; and (iii) donors and International Financial Institutions (IFIs) leverage to fund additional investments in water infrastructure (Luwesi 2011; WASREB and WSP 2011).

Performance of the Water Sector in Kenya: The performance report by WASREB (2012) shows some improvement in the performance of 46 WSPs in 2010-2011 compared to the year 2008 (Table 3).

Figure 4: Water services in urban settings



Source: KNBS (2010)

The most performing WSPs were classified into three types: (Type 1) those not having achieved the full cost of O&M; (Type 2) those having covered full O&Ms but unable to repay pending debts; and (Type 3) those having covered between 100 % and 150 % of O&M costs and partly or fully repaid their debts. Most WSPs lacked consistency, except for 21 Type 3 cases located in major towns such as Nairobi, Mombasa, Kisumu, Nyeri and Meru. Hence, WASREB and WSP (2011) could stress on the more urgent financing needs for sanitation infrastructure, even in urban areas where households were connected to water and sewerage lines. Moreover, water sector financing in Kenya, especially infrastructure development, becomes a burden for IFIs and donors since they carry a 56.5 % share of the total budget (WASREB 2012). These financial challenges may hamper the smooth implementation of water sector reforms.

Without proper tariffs, the Kenyan water sector will depend heavily on donor and IFI funding for infrastructure development. Yet, the current international financial environment is not such as to enable the Kenyan government

Table 3: WSP performance in 2010–2011

Indicators	2008/2009	2008/2010
Number WSPs	46	39 %
Number WSPs with sewerage systems	21	23
Water Coverage	46 %	6 7%
Sanitation Coverage	47 %	67 %
Sewerage coverage (Nairobi)	30 %	28 %
Sewerage coverage (Mombasa)	7 %	4 %
Average sewerage coverage (Kenya)	15 %	15 %

Source: WASREB (2012)

to raise sufficient funds by 2015 to achieve its strategic targets for water, sewage and drainage s infrastructure, notably 40 % to 70% for water supply and 5 % to 10 % for sewage and drainage services in rural areas, and 60 % to 80 % for water supply and 30 % to 40 % for sewage and drainage services in urban areas (Bouwer 2003; AMCW et al. 2006; GOK 2008; World Bank et al. 2008).

Besides, the prospects of a water balance in Kenya by 2050 are gloomy in all the major basins. It is clear that irrigation demands associated with the targets in the Kenya Vision 2030 are unrealistic and need to be reduced (Falkenmark and Rockström 2004; Mogaka et al. 2006; Mumma et al. 2011). Therefore, water sector sustainability may be achieved through inclusive financing and management of water resources and related infrastructures by communities (Dyszynski 2010). The following section examines the contribution of CWMSs in ensuring water security in the Ngaciuma-Kinyaritha Catchment.

CWMSs' Contribution to Domestic Water Security in Ngaciuma-Kinyaritha

Performance Assessment and Evaluation: CWMS performance in managing water resources and providing water services in Ngaciuma-Kinyaritha recorded a total ratio of 53.6 %, while their WRUA and WSP counterparts fared "fairly well" (62.2 % and 54.4 %, respectively). Even so, their shared contribution to water security was as "fairly poor," that is below 40 % and above 30 % (Table 4). In effect, CWMSs' contribution to water supply sustainability and environmental management was rated "fairly poor" (below 50 %), owing to insufficient and inadequate technological means and the lack of contingent plans to address water disasters (Table 5).

Nonetheless, all water institutions performed "fairly well" in water resource management and social inclusion with overall ratios rising above 60 % (Table 6). CWMSs were particularly lauded for being socially inclusive, especially when it came to decision-making and conflict resolution (60 %) and to inte-

Table 4: Performance utility ratios of water institutions in Ngaciuma-Kinyaritha

CONTRIBUTION	CWMS		MEWASS		NGAKINYA WRUA	
	Rate	Performance	Rate	Performance	Rate	Performance
Water supply sustainability and environmental management	50.0 %	Fairly well	54.4 %	Fairly well	62.2 %	Fairly poor
Water resource management and social inclusion	62.2 %	Fairly well	60.0 %	Fairly well	71.1 %	Fairly well
Economic development and business success	36.0 %	Fairly well	68.0 %	Fairly well	68.0 %	Fairly poor
Farming water development and profitability	62.0 %	Fairly well	46.0 %	Fairly poor	62.0 %	Fairly well
Rating	53.6 %	Fairly well	57.1 %	Fairly well	66.1 %	Fairly well
Performance	30.3 %	Fairly Poor	32.3 %	Fairly Poor	37.4 %	Fairly Poor

Source: Mathenge et al. (2014)

Table 5: Water services provision and sustainability in Ngaciuma-Kinyaritha

No	CONTRIBUTION	CWMS	MEWASS	NGAKINYA WRUA
1.	Reduced distance to water source	50	80	60
2.	Increased water quality	40	70	40
3.	Enhanced water services affordability	80	50	70
4.	Water supply self-sufficiency	30	80	60
5.	Catchment management capability	80	30	90
6.	Drought prevention /preparedness	30	0	40
7.	Water management/ services modernisation	40	80	60
8.	Soil conservation effectiveness	60	20	80
9.	Water conservation effectiveness	40	80	60
	Rating	50 %	54.4 %	62.2 %
	Performance	Fairly Poor	Fairly Well	Fairly Well

Source: Mathenge et al. (2014)

Table 6: Water resource management and social inclusion in Ngaciuma-Kinyaritha

No	CONTRIBUTION	CWMS	MEWASS	NGAKINYA WRUA
1.	Local culture on water supply/ management	100	75	80
2.	Gender sensitive water supply / management (women and men equality)	100	75	100
3.	Welfare improvement	50	50	60
4.	Decreased frequency of drought	50	0	60
5.	Reduced distance for fetching water	50	90	60
6.	Reduced time for fetching water	50	80	60
7.	Reduced cases of water borne diseases	40	80	60
8.	Public consultation/ involvement in decision-making	60	20	80
9.	Decreased cases of conflict on water use	60	70	80
	Rating	62.2 %	60 %	71.1 %
	Performance	Fairly Well	Fairly Well	Fairly Well

Source: Mathenge et al. (2014)

grating local culture and gender sensitivity in their daily management (100 %) (Table 6). However, technological inefficiency was a hindrance to improving community welfare through notably good water hygiene practices and drought control measures, as well in as in reducing the time and distance for fetching water (50 %). Thus, they were rated "fairly well" (62.2 %).

CWMSs' contribution to economic development and business success was found to be fairly ineffective (50 %), and thus could not add value to the existing infrastructure in the catchment (25 %). They could not control water price fluctuations due to seasonality (50 %) or foster new businesses (35 %).

Table 7: Economic development and business success in Ngaciuma-Kinyaritha

No	CONTRIBUTION	CWMS	MEWASS	NGAKINYA WRUA
1.	Water supply/ management network coverage	20	60	90
2.	Use of water charges (tariff/ price)	50	100	100
3.	New investments in irrigation schemes in the area	25	20	35
4.	Increased economic activities due to water development	35	75	40
5.	Reduced seasonal variability of water cost	50	85	75
	Rating	36 %	68 %	68 %
	Performance	Fairly Poor	Fairly Good	Fairly Good

Source: Mathenge et al. (2014)

Table 8: Water development and farming profitability in Ngaciuma-Kinyaritha

No	CONTRIBUTION	CWMS	MEWASS	NGAKINYA WRUA
1.	Water conservation and rain harvesting for agriculture	60	20	60
2.	Reduced water cost in farming	50	30	40
3.	Increased yield in farming	40	60	50
4.	Farmers adhering to community water management system	100	20	80
5.	Farmers paying for more effective and efficient water management	60	100	80
	Rating	62 %	46 %	62 %
	Performance	Fairly well	Fairly Poor	Fairly well

Source: Mathenge et al. (2014)

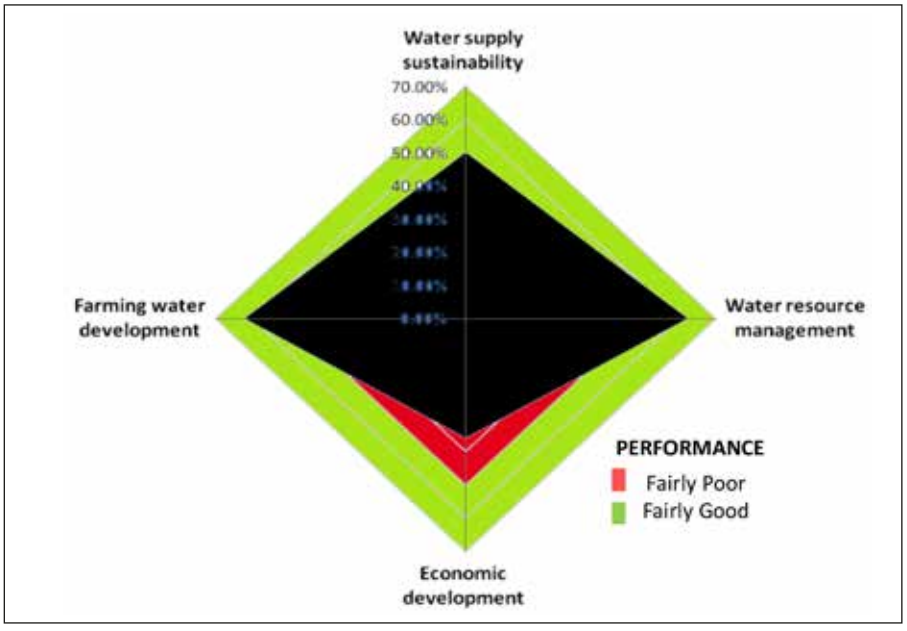
Hence, their overall performance in the economic and business sector was recorded as "fairly poor" ratio (36 %) (Table 7).

Table 8 reveals that CWMSs like NGAKINYA WRUA have a fair capability (62 %) in developing water resources to ensure farming profitability, which WSPs do not have. CWMSs have a strong influence on community beliefs and motivations and can play a key role in mobilising community members, especially women, to participate in the implementation of water and soil conservation measures in the catchment. In addition, they can encourage farmers to harvest rainwater and pay for environmental services, even though they have limited capability to manage water costs and increase farm yield. Hence, globally rated, CWMSs' water governance capability in Ngaciuma-Kinyaritha Catchment was rated as "fairly well," but their share in achieving water security was "fairly poor," just like other water institutions (Figure 5).

Discussion on CWMSs' Contribution to Domestic Water Security

With the ongoing implementation of water sector reforms, WSPs (notably MEWASS) and the NGAKINYA WRUA are wholly able to achieve nearly 70 % of water security targets in Ngaciuma-Kinyaritha Catchment. The remaining one-third can be attributed to the CWMSs, mostly known as "Self-Help" groups.

Figure 5: Overall performance of CWMSs in Ngaciuma-Kinyaritha



Note: The black polygon in the centre represents CWMS performance in Ngaciuma-Kinyaritha

This disparity in the management and usage of water has resulted in poor performance of water projects in Kenya and other developing countries (Maharaj et al. 1999; Suda 2000).

Therefore, the future welfare of community living in Ngaciuma-Kinyaritha Catchment will depend on cooperation among all established institutions both at local and national levels. Policy-makers, on one hand, and local community leaders, on the other, need to define a coherent management framework and enforcement mechanisms (Ayling and Kelly 1997). When government policies and laws start conflicting with local people's traditions and cultural practices, one can expect progressive degradation of the quality and quantity of water flowing in the catchment (Shivoga et al. 2007). This is typical of the current legal environment for the water sector in Kenya, where CWMSs are significantly excluded from both catchment management and rural water supply. Negative environmental impacts are foreseen in areas where no WRUA is operational if CWMSs collapse or decide to give up ahead of the enforcement of the Water Act 2014 (Lelo et al. 2005).

Conclusion and recommendations

The status of water security in Kenya in general and in Ngaciuma-Kinyaritha Catchment in particular, is volatile and needs to be urgently addressed. There

is thus a need for a more inclusive and multi-pronged approach to solving the many problems facing catchment areas in the country. Sustainability in water resources and sanitation services also requires adequate investment in infrastructure development. When coupled with good infrastructure and technological innovativeness, community participation in the development of water and sanitation infrastructures may achieve the targets of the water sector reforms under the stewardship of CWMSs. Though informal, these self-help groups are already achieving 30 % of the targets of the reforms in Ngaciuma-Kinyaritha Catchment, just like any WSP or WRUA. Hence, there is a need for large-scale inclusion of the masses through dialogue forums surrounding water legislation to foster community participation and ease the water inequalities facing certain stakeholders. The latter should be empowered politically, legally and financially to meet their demands for water in the course of climate change.

Key policies and research implications

The water crisis is the result of the current legal environment in Kenya, which technically locks traditional CWMSs out of the water business to the benefit of WRUAs and WSPs. CWMSs are significantly excluded from both catchment management and rural water supply. Yet, in areas where no WRUAs and WSPs are operational, water security is crucial, owing to negative environmental impacts, lack of water infrastructure and/or the collapse of CWMSs. This collapse is foreseeable where CWMSs are banned or forced to give up ahead of the enforcement of the revised Water Act 2014. Hence, it is imperative for the Government of Kenya to include all stakeholders in the ongoing dialogue surrounding the new act. These discussions shall also consider recommendations from The *Ramsar Convention*, formally known as the *Convention on Wetlands of International Importance*, which advocates for the conservation and sustainable utilization of wetlands, especially waterfowl habitats. By recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value, the new water act would empower CWMSs to enforce laws that mitigate adverse environmental impacts going on in the catchment.

Moreover, water security also involves the sustainability of water resources and services. This requires adequate investment in infrastructure development and technological innovation. The government and its institutional partners must therefore ensure cost-recovery through tariffs and taxes to provide for water investments and minimise dependence on donor funding. Community participation in financing the development of water and sanitation infrastructure thus becomes very significant in achieving the targets of the water sector reforms. Researchers are particularly urged to identify innovative economic tactics to raise funding for agricultural water development through mechanisms such as Payment for Watershed Services (PWS) and blended financial instruments. There is

also a need for assessing alternative technological and environmental measures implementable at small catchment level by CWMSs to ensure Green Water Saving (GWS) in wider basins in the country, namely Athi, Ewaso-N'giro, Lake Victoria North, Lake Victoria South, Rift Valley and Tana. Enhancement of the capability of CWMS managers in strategic water business planning and technological innovation may be achieved through implementation of new professional curricula at the Kenya Water Institute (KEWI).

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