Nascent Concerns on the Sustainable Management of User Community-Based Approaches in Water Resources and Supply: A Case of River Njoro Watershed, Kenya

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Abstract: ***This paper is the cumulative work that explores the experiences of communities and stakeholders in implementing sustainable options in operation, maintenance and administration of community managed water sources. Information was collected from households, system operators, focus group discussions, and key sector informants in River Njoro watershed communities. The findings are that 80.9% of the surveyed communities depended on community water sources. Survey data revealed that 22% of the sources were dysfunctional. Reasons cited for non-functioning included that of breakdown of installations (28%), high volcanic fluoride (10%) and drying up boreholes (62%).Water committees were established for most systems to define and manage its operations. Regardless of large number of schemes observed, success was attributable to the principles of community involvement, management, sensitization, education and ownership. This study proposes several interventions for reinforcing their sustainability.***

Keywords: Sustainable, User Community, Community managed, Water schemes, River Njoro Watershed

1. Introduction

There exist severe constraints to access water by rural communities in Africa. Communities often have considerable difficulty in sustaining operation and maintenance (O&M) of water supply infrastructure over the useful life of the hardware [1]-[2]. Kenya has also witnessed poor records of sustainability for water infrastructure (especially in rural areas. In 2008, an estimated 52% of Kenyans households in rural areas were considered to have access to improved water supply [3]. In addition, the Rural Water Supply Network [4], approximates that 30% of the estimated 12,000 hand pumps in the country are dysfunctional, and a similar proportion of piped water systems are under pressure by partial or total system failure.

In an effort to improve sustainability of and rates of access to improved water supply, the Water Act 2002 ("the Act") had decoupled water resources management from water service provision (Fig.1); decentralized water service delivery to user communities; hence improved accountability and communication between water consumers and water service providers. According to [5], most sectors in international development planning and management in Africa; management of rural water supplies inclusive, community ownership and control has over recent years received extensive approval. [6] elaborates that 'The past few decades have witnessed a burgeoning number of projects in various parts of the world in natural resource management with the prefix 'community' attached to them.' However, the key challenge to community water provision in Kenya is the post construction sustainability of water schemes.

Recently the rural water sub-sector has gradually integrated community participation in the planning and construction of projects in an attempt to tackle this sustainability challenge, [1]; [7]. At a global perspective, this swing toward participatory planning and construction has been accredited with enhanced sustainability in rural water projects [8], [9]. In particular, sector actors and researchers extensively cite the crucial role that community participation plays in stimulating a sense of ownership for the water system, which in turn guarantees users' commitment to long term functioning and maintenance; such as toward the capital costs of system construction [10]; [8].

To achieve this goal, one identified strategic action is to "increase investments and ownership for sustainable access to water in rural areas," as well as to "[achieve] sustainability of rural water systems by promoting beneficiary participation in planning, implementation, and management" [11]. Sustainability of these projects is crucial if the investments are to last long beyond the project period and have a longer term impact.

The study is based on data gathered from rural communities in the River Njoro Watershed, where according to Rift Valley Water Services Board (RVWSB, unpublished); development for water infrastructure installation has incorporated various approaches to community participation over the years. Using information gathered from the watershed, the study explores the extent to which sustainability of communal water source has been achieved. The study also investigated the forms of community participation pursued during projects planning and construction that point to sustainability.

2. Operational Frameworks on Water Resources and Supply in Kenya

Actors in the water sector in Kenya recently initiated the Water Service Providers (WSPs) approach under the Act. The WSPs became the building blocks for users' participation in water provision. The structure of governance

in the Water Sector is shown in figure 1. In spite of the adoption of WSPs based management as a strategy for managing rural water schemes, there is diminutive appreciation of the "nascent dynamics" that constrain the success or collapse of such water management entities.

A key plank of the reform was to improve the quality and sustainability of water supplies by increasing the autonomy of rural WSPs. Providers are tasked with the projects' development, management and operation are separated from regulation functions, now the mandate of the Water Services Regulatory Board (WASREB), and from oversight functions, done by the seven autonomous regional Water Services Boards (WSBs). Government funds for capital investment will flow through the Water Services Trust Fund (WSTF) or the WSBs. The exact role played by members of community will vary depending on project scale and complexity, the water provider itself and funding arrangements. Whatever form it takes, each water provider will have to enter into a service provision agreement with its WSB.

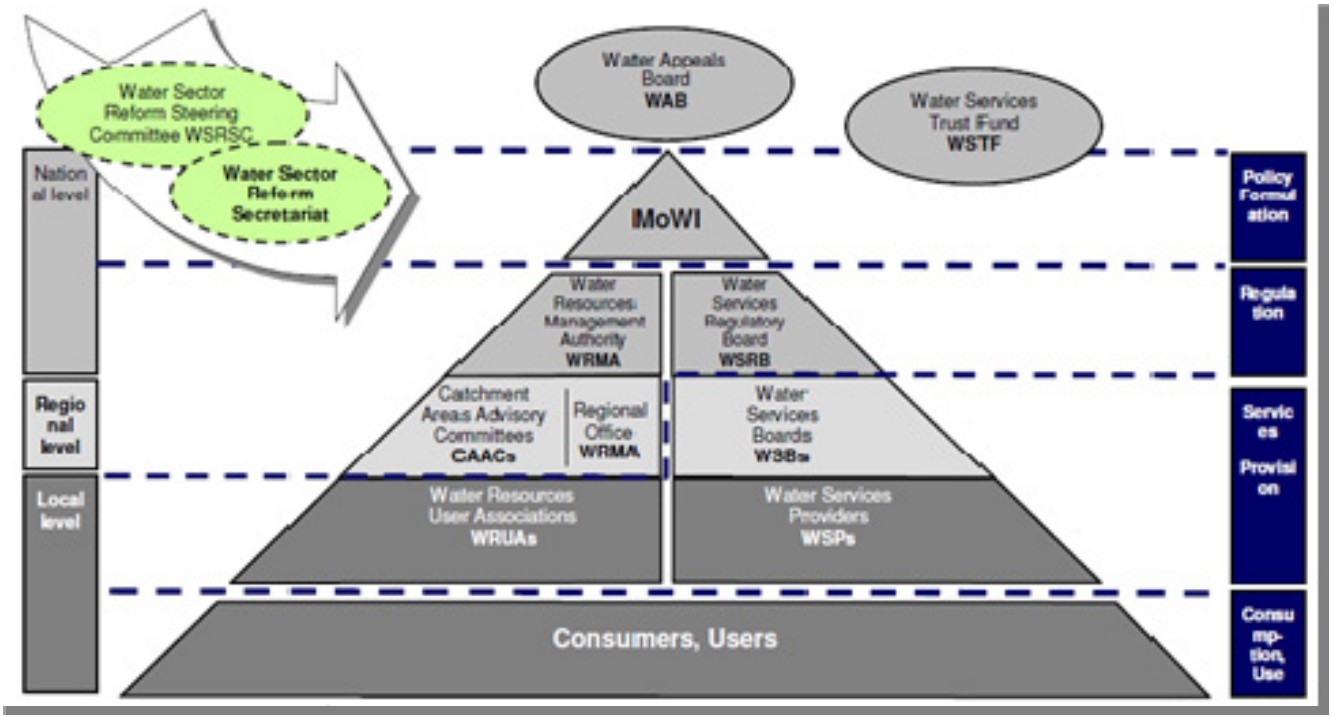

Figure 1: Water Act 2002 Institutional Framework. Notice the clear separation between water resources management and water service provision. The place of Water Services Providers (WSPs) is shown. [Source: Water Sector Reform Secretariat]

The rural water sector in Kenya had undergone reform, which included the development of a new policy [12], legal instruments (the Act) and institutional transformation process to address both water service delivery and integrated water resource management. The Water Policy includes the following key principles; to ensure that existing water supply schemes are rehabilitated and put under sound management involving the beneficiary communities and other stakeholders, self-sustaining water systems where beneficiaries are encouraged to take full responsibility for operations and maintenance and strategies can be pursued within a participatory framework involving the communities and other parties in designing, constructing and managing the water utilities or other providers. Government will support private participation and community management of services backed by measures to strengthen local institutions in implementing and sustaining water programs. These alterations call for institutional reforms that uphold an incorporated approach, together with changes in practices, attitudes and conduct and ensuring gender balance in participation throughout the sector and institutions.

This study seeks to scrutinize the functioning of this strategy in Njoro watershed and consequences on its sustainability. It seeks to unveil the issues that determine the success or failure of WSPs. An attempt is made to provide insights into how sustainability of User-based water projects can be ensured to foster better social economic development (in particular to enhance access to water resources) at the local/community levels.

3. Research Methodology

3.1. Target Population and Sampling Method

The study adopted a multi stage cluster sampling technique in selecting specific villages and households to be studied. The three catchment divisions (Upper, Middle and Lower) were purposively selected to ensure an adequate geographical spread and watershed hydrological coverage. The households in the all villages were also picked using a systematic random sampling technique. Interviewed people were only household members who live in the house and adults (18 years and older). As far as possible an equal number of men and women were interviewed.

The target area was the catchment divisions across the study area. It is estimated that there were 14398 households in the communal households at the time of the study in 2013. The study was limited to the entire watershed because their hydrological conditions are dissimilar throughout. Nessuit,

Beeston, Mwigito and Njokerio are in the upper catchment of the study area where the rainfall amount is higher than the lower catchment (Piave, Ingabor, Ngata Mogoon, Baruti, Kaptembwa and Ronda) of the area.

3.2. Data Collection Methods

Three major data collection instruments were employed and these were the Household questionnaire, In-depth Interviews with key sector informants and Focus Group Discussions (FGDs). The household questionnaire was succinct: 6 questions targeting household demographics, household knowledge, ownership, management (attitudes, practices and conduct), cost of access, and historical operation (participation in planning construction and post-construction). The median length of an interview was 20 minutes.

FGDs were used to collect data on collective community views concerning community based water resources management from community members and water point committees. Informed water specialists and other stakeholders who included the Water Resource Management Authority (WRMA) officials, Service Board officials and Administrative Officers provided information at the In-depth interviews. Data collection was done by a team consisting of 10 enumerators. The enumerators underwent mandatory training before going into the field so that they could ask and record correct reactions. The survey was carried out over a period of ten days. A total of 421 households were sampled.

The data collected on questionnaires was analyzed by utilizing the various components of the Statistical Package for Social Sciences (SPSS). FGD's qualitative data and sector informants' interviews were processed using Atlas.ti.

4. Results and Discussion

4.1. Access to Water Sources

Results of the surveyed population showed that there are five most common water sources in Njoro Watershed are streams, boreholes, rainwater, springs and protected dug wells. Although surface water is used in areas like Njokerio and Njoro, it was only in Nessuit where a substantial population of surface water users could be found. In rural areas (specifically in Nessuit) there is total lack of piped water system. There are a few boreholes and most people rely on surface water sources for drinking water (streams and springs). Respondents were asked to tick the types of water sources accessible by them. Incase several sources were accessible; respondents could mark all the available sources.

The results of the survey indicated that 35% of the surveyed households access water from protected sources for drinking purposes. This means that at least 65% of the households use drinking water from unprotected sources (streams and unprotected springs). However, it is important to note that some unprotected water sources were not in use as some of those communities that use protected water sources during the period often resort to unprotected sources at some point of the dry season (January- March). The majority (38%) of households surveyed pointed out that they primarily use water from streams as their source of drinking water, while about 2% obtain water from boreholes. Two percent (2%) of the households highlighted that they used water from protected dug wells. Another 56% of the households pointed out that they primarily use springs. A Community Based Organization (CBO) called Jikaze Women's Group has assisted women in Njoro area to construct rain water tanks in their homesteads.

Ninety three percent (93%) of rural respondents considers drinking water sources to be unsafe due to contamination and high turbidity but only 43% treat it to improve quality. In contrast, in urban areas, water is considered safe by 52% and yet about 80% treat water before use. The respondents were probed why they considered the water unsafe. About 50% pointed out the issue of contamination by both by fecal matter, 38% mentioned the issue of turbidity, about 4% mentioned both turbidity and contamination, 1.4% said the water smells and 5.2% pointed out combined reasons. Njoro River normally contains poor quality water resulting from high contamination [13] and turbid water caused by watershed degradation. Also research findings by Sustainable Management of rural Watersheds (SUMAWA) [14] project in the area indicate that the river water is contaminated as it contains up to 3.6 and 244 MPN/ml of fecal and total coliform. According to [15], this figure can be as high as 1880 and >2700MPN/Ml for fecal and total coliform respectively downstream of the river and should not therefore be consumed without treating it (figure 2).

[16] during Proceedings of the SUMAWA Mau Conference, presented a paper entitled "Patterns and Sources of Faecal Pollution in the Heavily Impaired River Njoro Watershed Kenya: Findings and Implications", showing temporal levels, trends and supplies of faecal pollution of the watershed, a vital basis of surface and ground water for ecosystem communities in and surrounding the watershed. They observed that widespread lack of access to improved water sources in the upper and middle watershed, frequent rationing and shortages of improved water source supplies in the middle and lower watershed, and higher prices charged for improved water to those without private connections implies that agricultural and poor peri-urban households and their livestock must use the river as the only source to water cattle. They conclusively demystified the water body as suitable for human, livestock consumption citing public health risks, and degrade aquatic ecosystems.

(a)

(b)

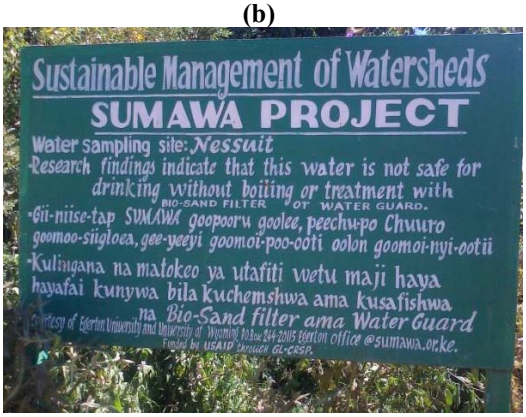

Figure 2: (a) Men fetching water from Njoro River (b) Public sign board warning people to not use the water without prior treatment [Source survey 2013]

Asked about the causes of river pollution during FGDs, most respondents were able to recognize the different sources of pollution, compared to household perceptions where majority (95%) pointed a finger at a particular polluter. Furthermore, the participants appreciated that the watershed's health can be restored by concerted efforts of all the stakeholders. It was revealed that the river runs dry periodically at Barut due to pressure from users; drought, shallow dams upstream for irrigation (within Barut); sand scooping; and obstruction of river flow (Rumwe). The consequence is that the residents lack alternative sources. When probed further, they were able to identify the riparian community as the main polluters and expected them to lead the action oriented efforts to conserve the watershed. The FGDs identified the actions they anticipated to be undertaken in order to restore the watershed and also understood the benefits to be accrued as a result of these actions. River Njoro-Water Resource User Association (NR-WRUA) should be a force to mobilize the entire community over the conservation issue. The primary point for outreach efforts is the RN-WRUA, which serves as the main point of contact between watershed communities, SUMAWA and WRMA. Central to the successful implementation of interventions is identifying key stakeholders and policymakers that are in positions of influence and ensuring that they are committed to the success of the proposed intervention. SUMAWA has been actively involved in offering learning opportunities for local stakeholders and land managers, including hosting a workshop within the watershed. A series of billboards had been placed at watering sites along the River Njoro clearly identifying the risks associated with utilizing the river water for consumption due to its poor quality (Fig. 2).

For other purposes, streams and unprotected springs provide the largest amounts of water at 58% and 24.7% respectively. Nevertheless still, some residents would obtain water from protected dug wells (14.7%) and protected springs (0.7%) depending on accessibility of the source.

Sixty percent (65%) of household respondents in rural Njoro indicated that their household members travelled distances in excess of 500 metres to access water. According to the Sphere Project (2011) cited in [17], the maximum standard walking distance to the nearest water source should be 0.5km in disaster situations. From the FGDs, it was noted that some households travelled up to 2 kilometres to the nearest water source especially during the dry season. In Ngata and Piave FGDs some households were reported to be travelling up to 6 kilometres to reach a water source. In Baruti and Ronda FGDs households were reported to be travelling up to 4 kilometres to reach a water source.

Information from the field trips and interaction with the community members revealed that Piave people had to walk for about six kilometres to get water for their domestic use. Of importance to note is the fact that many people are venturing into water vending business where they get river water and sell it, normally without treatment, to people in town especially in Piave and Njoro. This has been necessitated by drying boreholes and long dry spells believed to be caused by the continuous destruction of Mau forest complex; the biggest water tower in Kenya.

Owing to the distance, some individuals relied on water for sale which could be very expensive (one jerican cost 12 Kenya shillings). However, whether they bought or fetched water from the river, the supply was inadequate, hardly enough for cooking and washing their bodies. There is a serious shortage of water at Piave and that which is available is polluted**.** One of the informants said: "…… *I think things are going to be better since we have sunk a borehole around Piave".* The large walking distances in most cases are attributed to most boreholes either broken down or were dry due to lowered water tables. Generally, it was noted that some boreholes and protected wells were in a serious state of disrepair. This result points to the fact that the current water rural community management systems needed a major overhaul.

The mean amount of water households consume for (drinking purposes only) is similar for both rural and urban areas (7.0 liters per day) despite the significant difference in the family sizes (6 in rural areas and 4.6 in urban areas). The survey data revealed that the average level of water usage far below the minimum requirement of 15 litres per person per day in disaster situations. This result was arrived at by dividing the average number of litres fetched per day by the average number of people per household. This result shows that Njoro Watershed is a high water scarce area. The ripple effect of this challenge is that hygiene standards were being compromised as villagers were not washing hands after using the latrines in order to save water.

As exposed at FGDs, the to water source and fro-time is significantly higher in rural areas (28.8 minutes) compared to urban areas (4.5 minutes). Sometimes residents of Baruti and Ronda were spending up to an hour at the dug wells waiting for the water source to replenish. It follows that the opportunity cost for fetching water is very high for rural populations.

Survey data from the household questionnaires revealed that 78% boreholes were functional with 22% being non-functional in the survey area. Reasons cited for non-functioning included that of breakdown of installations (28%), high volcanic fluoride (10%) and drying up boreholes (62%). At Egerton University, at least six out of fourteen boreholes have dried up. At nearby Ngondu, some

boreholes had become saline. [14] observed "In fact, several boreholes within the watershed have gone dry in recent years, to the point where Egerton University (within middle catchment) had commissioned a task force to respond to a water availability crisis in the campus due to declining borehole functioning" it is this drying up of water wells that has motivated the population to migrate to areas where water might be easily accessible, such as Njoro town.

4.2. Ownership of the Watershed Water Resources

The study measured community members' sense of ownership for the water system as defined by expressed attitudes by households on ownership and commitment related to the infrastructure. [9] hypothesize that all forms of community participation are affirmatively correlated with a sense of ownership for water infrastructure among community members.

The study established that water sources in the study area are generally community owned. Slightly over seventy percent (70.9%) of the households interviewed said that the water sources they use are communally owned. Twenty six percent (26%) of the households used sources owned by various institutions including the Corporations such as the Egerton University and Kenya Agricultural Research Institute (KARI), local government, government hospitals, schools and NGOs. The remainder (3.1%) of the households used water sources that were privately owned by their families. However, within Mwigito area (Middle Catchment), groundwater boreholes are the common water sources owned privately with exception of Mwihoti Water Project a community borehole. Privately owners of water boreholes include Kiragu Dairy Farm, Kiptanui Dairy Farm, Njoro Canning Factory, KH Flower Company and Gikombo Farm (have one borehole each). Egerton University has 14 boreholes (with only 8 functional) while KARI has 3 boreholes.

When this question was posed to some households, it was found that communities strongly connected the ownership of water sources with the particular agency that would have constructed the water source. Communities often referred to boreholes and dug wells by the name of the agency that constructed it by for example deriving its name from the constructing agency like 'CDF water' (Constituency Development Fund water), 'Lutheran' (Lutheran World Relief), 'FSK water'(Farming Systems Kenya), 'Catholic Water' (St. Lwanga Catholic Church) or 'Malaika water'(Salama Malaika). Salama Malaika, St. Lwanga Catholic Church, Lutheran World Relief and Farming Systems Kenya (FSK) were some of the organisations working in Njoro Watershed to provide access to water and improve livelihoods for communities. FSK had undertook the planning and implementation various water projects including Njokerio community water project, Bagaria community water project and Gichobo community water project all Njoro. Other community water programmes include Mwariki water project, Mauche Community Water Project, Kapyemit Water Project, Kimanji Water Project, Eriithia Ndarugu Water Project, Nganoini Community Water Project, Kaburu Water Water Project, Nganoini Community Water Project which were funded by the Constituency Development Fund (CDF).in most cases it was found that Non Governmental Organizations supported the communities to develop proposals which were successfully funded and implemented.

[18-19] working in the field of organizational and behavioral science, however, can provide a useful basis for this observation. They developed the psychological ownership construct, described as "that state in which individuals feel as though the target of ownership (material or immaterial in nature) or a piece of it is 'theirs'. They theorize that the three main causal pathways for developing a sense of ownership for an entity are investing oneself into it, intimately knowing, and controlling it. More recently, however [20] widened this hypothesis to contain the possibility for a collective attitude among members of a cluster within precise work situations, known as collective psychological ownership. This points out that lack of community participation at planning and construction stages may emanate from lack of sense of ownership and consequently a lack of investing oneself into it.

The feeling of ownership actually became observably low when it was clear that the particular water source was in a deplorable condition; for example with broken installations (not operational) and therefore requiring repairs. The high levels of breakdown of community owned boreholes may be attributed to this fact. This is further approved by [21] point out that a lack of feeling of ownership on the part of the community is to blame for the failure of community managed projects.

In this framework most water sources are communally owned, it would be compulsory that any rural water policies for the area studied ensure optimum participation by resident community at planning and implementation. The management of community owned water points presents different dynamics from those of privately owned water sources [17]. According to [5] the issue of communal ownership is incredibly different to individual ownership, yet it is a widespread mistake to view them in alike. The significant divergence between the two types of ownership is that with individual rights the particular individual is entirely responsible for the maintenance of the water source. Where a community owns the water source complications normally arise when it comes to the financing of the maintenance [17].

Findings from the study showed that across the watershed communities still had expectation to that the providers of water sources would repair and maintain it. It was observed that many water point committees were approaching the agencies that constructed the water sources to assist with their repairs whenever they broke down. The feeling of ownership of the water sources was therefore observably low.

It should be noted that most (98%) of classified (private) water sources were at the time of the survey reported to be operating effectively. This state of affairs could be attributed to repairs and maintenance responsibilities being handled squarely by the proprietor of the source. Therefore, there time for consultation on who should pay for the repair of the source is effectively done away with. The study also found

that privately owned sources rarely break down. It was logically concluded that private owners exercise extreme care and caution in using their sources in view of the fact that they are the cost centers in case of breakage. Secondly, water sources under community ownership endure pressure from the large number of users. It was found from the survey showed that on average a population of 500 people shared a single borehole in comparison with a standard figure of 250 people per borehole.

4.3. Community Participation in the Water Schemes

For community owned water sources, it was found that the majority of study participants had clear recollections about the construction event, despite the median length of time since water system construction of seven years, because they were living in their village during the planning and construction of their water systems. Some households narrated how projects started as self-help groups and the journey towards acquiring more formal legal status over time. Most heads of household were able to recall the extent of their family's participation in pre- construction meetings and decision-making related to the design of their community's water system; only 5.3% were unable to answer questions about these topics.

Seventy nine percent (79%) said they had been aware of the water project before construction began, and 68% identified local actors (e.g., village residents, the water committee,) as having had the greatest influence over decisions related to setting water tariffs, the levels of service that would be provided and the amount of up-front contributions required of users. This information agrees with data collected from water committee members, 86% of whom reported that community members organized without external support to initiate the project that resulted in their water system's installation. 24% of respondents reported that no one in their household attended meetings related to planning for water supply improvements before construction of the system began. Forty four percent of households said that they were involved in deciding what sort of contribution households would be expected to make toward construction of the system; one third said they were involved in decisions. A few heads of households reported that they donated their land to host the water project.

During some FGDs it was found that before project implementation is established communities are informed by lead agencies to collect money for operation and maintenance and deposit it in a bank account. Communities are asked to sustain either monthly or yearly contributions. In actual sense these payments are only made when the scheme breaks down and requires a revamp. There are different forms of participation; unskilled labour, materials or money are some of the most frequent. To provide unskilled labour the members organize group them to do the work, or even hire people to do work on their behalf. At times women supply rations for the labourers as part of their input. Financial household or family contributions are usually collected at the water source irrespective of whether they can afford it or not. In certain areas pump attendants do not pay for water.

Narrations by residents in most of the cases would show that community financial investment in rural water supplies in the area was high at inception stages. Sixty percent of respondents were able to report the amount of money they had contributed to the installation of the water system. Among the 40% of sampled households who reported making up-front cash contributions toward water system construction, the median cash payment was US$75 (in 2013). For some communities, such contributions were viewed as quasi membership dues that enabled households to have the option of obtaining an individual tap in the future. Installing this high level of service required additional, distinct payments that often ranged into the hundreds of US$s given the dispersed settlement patterns of sample communities. Ninety-two percent of households could recollect how they contributed in provisos of labor during water system construction. Among the 60% who said their household did contribute labor, however, almost half (48%) could not recall the precise number of person-days of labor devoted.

Local communities could also report that some new schemes and major rehabilitation have invariably been financed partly from local fundraising, while operations have a reliable cash flow from user tariffs.

4.4. Water Point User Committees and other Structures of Governance

User community commitment and interest to run schemes is high for the watershed. The principal appendage for Community Based Water Resources Management in Africa's rural areas is what is known as water committees. The committees are responsible for implementing the rules and the regulations regulations agreed on by the communities in the particular source, marshal financial resources for the payment of operational cost in case of breakdowns, reporting system collapses, conducting regular meetings so as to identify and resolve problems associated to the maintenance of the water sources. One or more technicians are responsible for operation, maintenance, and repair of the water supply infrastructure.

Fifty four percent (54%) of households said that there was no water point committee responsible for their water source. Thirty eight percent (38%) of the household respondents mentioned knowledge of water point user committees for their water source. The remainder (8%) denied knowledge of a water source committee for their source; the majority of whom are residents of the middle catchment with piped water connections and they were not known by the community. The water committees were existent in areas where the water points were functional; whilst in areas where the water points were non functional the water point user committees were no longer functional; hence not known by the community. It remains a subject of inquiry whether the breakdown of water points caused the 'death' of water committees or vice-versa. The communities indicated that where the water committee is active the water points could go for up to six months without major breakdowns and does not take long time for the break downs to be reported and attended to.

Most water point committees are comprised of 7 members namely; Chairperson, Vice Chairperson, Secretary, Vice Secretary, Treasurer and 2 member representatives. Exceptionally water point committee of Njoro Community Water Project, was found to be composed of eleven members - six of whom are women - has been formed to manage the daily operations of the scheme. The water source user groups democratically elected their associates to serve in the water point committees. The water management committees in most of the water sources constitute near equal figures between women and men. However, the leadership of water committees is dominated by men in rural areas of the upper and middle catchment occupying prominent positions like that of the Chairperson and the Treasurer. This is in contrast with the findings that in 80% percent of the households, it is women who are responsible for fetching water. Gender inequality was found to be a barrier to the efficiency of water committees. For instance the CPC proposes that giving more attention to the service demands of women as well as men, of the poor members of a community as well as those who are better off, pays off directly in terms of sustainability of the services; providing greater voice and choice to all during the process of service establishment results in greater equity later, a better distribution of the burdens and benefits among community members, and improved water supplies.

The findings of the study were that although a few water sources had functional water committees, most water sources had none. The functional committees were in some instances impromptu groups of persons who came together when a water point was not functioning properly. Most water point committees broke down when members either died or migrated to new resettlement areas. There was need to capacity enhance communities to manage their water points sustainably. The revival of water point committees would be a critical element of capacity building by the WSBs.
The study further observed that functioning of most Water Committees was threatened. This was caused by a number of reasons. Firstly, some members in the lower and middle catchment had migrated to new resettlement areas since this is mainly peri-urban environment. Secondly, many members had died due to natural causes. Lastly, some members had pulled out due to lack of interest and motivation. The study found that early establishment, training regular motivation, of the water users committee may help to build community ownership and control from the beginning. Efforts should be made in order to replace those who had died and those who withdraw or migrate to other places.

In the absence of consistent leadership of water committees, they gradually dissolve and become dysfunctional. [5] in [17] correctly point out that observations from surveys conducted in Ghana, Zambia, and Uganda revealed that user community based water resources management is the only sustainable approach; where either a local government or NGO is actively playing an active task in supporting the community. However, the outcome of this study propose that beneficiary based water resources management as a concept would not function where there are no adequate supervision, regulation, financing, motivation and capacity to organize and run their own water systems.

4.5. Sustainability Challenges Faced by Water Point User Committees

Whereas these committees have endeavored to keep water sources useful, they face various sustainability challenges. There are no existing mechanisms to ensure a constant resuscitation and rejuvenation of the committees that face depletion due to various factors. It is evident that the missing element in rural water supply programming is the issue of post- construction costs; for the maintenance and operation after the departure of the constructing agency or government department. [22] notes that the constructing agent the new infrastructure does not assume liability pertaining to the issue of operation and maintenance cost and is little concern to the institutions funding the new infrastructure. Over-emphasis is placed on the installation of infrastructure without considering real-life complexities of how it will be maintained. [23] highlight that the cost of operating and maintaining new boreholes is three times higher than the cost required to expand coverage into new areas, and yet planners remain blindfolded to these costs. Most rural communities in River Njoro watershed live under the poverty datum line. This means that maintaining boreholes becomes a challenge especially in view of the amount of money required to do so. Enquiries from suppliers and local community showed that a full borehole repair and rehabilitation would cost on average $3000 (USD). In instances where the breakdowns were frequent this amount would accumulate to larger sums. Fortunately, most water committees seek funding from Constituency Development Fund (CDF) of maintenance and operations of the water sources under their jurisdiction; successful application also depends on the political goodwill. For example Gichobo Water Project, Njokerio Mwihoti Water Project, Upper Kamwago Water Project, Mwigito Community Water, Nganoini Water Project, Sinedet Water and Kaiyaba Water have been enabled by the CDF facility to purchase pipes, water tanks, submersible pumps and transformer and also meet other repair and maintainance costs.

However, it was found that CDF kitty could be relied upon entirely to meet the funds required by these community projects. Resident community users were expected by the water point committees to cater for the remaining cost. The research found out that members differed in capacities and forms in which they could support water services: in kind or in cash, in lump sums or installments, in equal amounts or according to their different capacities. Some residents pointed out that some households were unable to contribute for the maintenance and repair of community water sources. This meant that they would gradually clear their debt. For instance, in the middle and Lower catchment (Ng'ambo, Ronda and Baruti) it was reported that households who failed to pay were sanctioned from using the refurbished boreholes by disconnecting their meters. Yet despite the disconnection, things somehow seem to 'work' for this group, but may not be equally well for all parties. Whether of good or questionable quality, through planned and unplanned means, by legal and illegal, self organized or externally facilitated - they get along have access to water. Noticing the prevailing environment, the picture of a orderly amalgamating governance bargaining starts to unravel amongst water committees.

A field interview with a water point committee member in charge of Mwalati Community Borehole project (located in the lower catchment) found that they only collected money from households in order to buy spares and pay for repairs labour when the borehole and/or water pipes broke down. It was also revealed that boreholes could be broken down for up to a few months while communities were collecting putting together resources for repair. Strategies to raise money for maintenance and repairs need to be considered more seriously. They should consider other side-projects run by the community such as poultry rearing or monthly subscriptions that accumulate towards that effect way before any breakdown occurs. It is felt that that accountability and trustworthy structures to handle community money be put in place because in some areas water users were reluctant to pay money in advance to because they feared that the funds would be misappropriated. Strongly speaking, maintenance cost should not be post-construction concern; The key strategy is as spelt out by [23] who argue that; "…. *establishing long-term, dynamic operation and maintenance practices requires a financial plan and enforceable operation standards... The financial plan should calculate and determine sources of funding for direct operation costs, future repair costs, institutional and training costs, including monitoring, and expansion costs...*"

Often detailed discussions on tariffs setting and long term financial policies is neglected. In the early years of operation this may not have severe implications, particularly in gravity-fed schemes where ongoing costs are small. However, once more grave maintenance concerns arise, this lack of financial foresight, coupled with a lack of ongoing support, can lead to a total collapse of the system. It was found that in some cases where long term financial plans, the funds were used for other community works or simply mismanaged, communities are unable to generate the income for operational costs or, more commonly, meet the costs of unexpected or costly repairs, such as replacing worn parts or reboring.

Once a project is constructed and operating, most national or local programs withdraw and move on to new communities, usually with the implicit understanding that they are leaving behind a robust community group, to operate the scheme in the long run. The assumption is that the investment in upfront community planning, build-up of social capital and capital cost sharing is sufficient to secure effective long-term management. However, the evidence to the contrary is strong and compelling many schemes in many countries fall rapidly into disrepair. The research recommends that the community and its development partners develop a handing over plan for the transfer of their responsibilities to the water supply and sanitation committee and local government technical bureaus. Development partners should assist the community to establish an agreement with local government technical bureaus for major technical repairs that may be required in the future.

Funds are managed by the water committees. Constraints include: distance to the banking facilities, misappropriation of funds and unaccountability. The general lack of understanding about bookkeeping within the communities aggravates the situation. Irregular reporting patterns also contribute. The normal accounting procedure is to make a list of those who paid subscription and monthly payments, and a list of expenses. Accounting is done on ad hoc basis, usually once every year or two, or when disputes occur. Regular accounting is often lacking in many of the community-managed systems.

The training received by the committee members is mostly of a general nature. Training for tasks and in routine management is not emphasized. Repair skills and bookkeeping are taught, while reporting and communication are not given much attention. Lectures are based on a pre-prepared curriculum encompassing both men and women. Learning is not interactive and little effort is made to train them for specific tasks. This needs to be improved to allow for more on-the-job training, role plays and learner-centred approaches.

4.6. Sustainability of Water Supply Service Projects

Improved access to water supply facilities has contributed to a better quality of life for women and the girl child. Women and the girl child, who earlier had to walk long distances to fetch water for household use now have more time to devote to more meaningful endeavors such as earning income, schooling, household and personal hygiene. In addition, more women are involved in the management of the rural water supply and sanitation projects increasing the likelihood of better accountability and hence sustainability. The Community Project Cycle (CPC) process advocates for a minimum of 30% representation of women in the committees. A reduction of water borne diseases was reported at the Mukutani water project. Projects employed rural workforce contributing to employment creation.

The ground water sources of Njoro Watershed are very high in fluoride, making dental and skeletal fluorosis a serious health problem in the community. Egerton University in collaboration with Minority Health and Health Disparities International Research Training (MHIRT) had established source water assessment studies aimed at delineating and protection program to provide essential technical data and information on water safety. The purpose of the program is to provide a delineation of the water sources, identifying their locations and characteristics, as well as identifying all pertinent factors that may bear on the quantity and quality of the water. Such information includes the size of the community that is served by the sources, land use practices and related activities, the surroundings of the sources, and potential threats. Involvement of community water management committees in this project may provide the participants exposure to and experience with the design and characterization of bioreactors for use in water purification.

There had been vivid NGO activity involved in bringing multi-water solutions to the communities. FSK, for instance involves the communities in addressing their water provision issues for them to own the projects after construction and thus ensure sustainability. Communities are trained on various important issues to improve management and also address related issues including health behavior and proper sanitation and the need to conserve the environment. The

communities are empowered to manage and run the water programmes sustainably.

Another risk to sustained achievement of outcomes is the rapidly growing population of Nakuru Basin. During the planning stage, the target population is usually low. For example during the planning of ADB projects across the region, the population was at 290,000. By 2009, (and due to the political instabilities of 2007/8), the population had already reached 473,288 and it anticipated to grow even faster, hence the percentage of population served may decline unless new sources are developed immediately. Again, declining income base of the communities of the Njoro area, means that a growing number may not be able to afford clean water from the improved sources, or at installed and metered kiosks and may continue to use the highly contaminated sources (eg.River Njoro remains the main source of water for the poor in River Njoro Watershed).
For the rural water supply projects, the sustainability arrangements are not fully implemented for most projects and there is the risk of beneficiaries' not meeting operation and maintenance costs if no follow up of these projects is made. Unaccounted For Water (UFW) remains very high at 46% [24] and this needs to be addressed if the projects are to make enough revenue and extend services to the low income areas. The ADB project did not make resources available for the expansion of the distribution network, which further contributed to the failure to reduce the UFW to the minimum levels. This is an area that new investment must be focused at. The new constitution in Kenya has provided a new legal framework whereby provision of water and sanitation services is through county governments with no mechanism of ring fencing revenues generated from water services. This may deprive the sector the much needed resources for offering improved services and expanding coverage.

Some water committees reported that their scheme uses water for many purposes, including domestic drinking water, small-scale agriculture and livestock. Some WSPs confirmed that income from their schemes was seasonal as a result of rainwater in the rainy seasons and that operation costs were heavily influenced by the scenario.

The chief rationale for success or failure stems from whether or not the community members have been involved throughout the scheme. The subject of ownership – who owns the improved water scheme? – is also a noteworthy causal factor. For instance, when the WSB and ADB constructed improved water systems and tendered them over to the community for operation and maintenance, these schemes were doomed to be unsuccessful as the constructors not only lacked the directorial support but were incapable to continue to provide any financial support. The community could not salvage the situation because it was somebody else's project, besides, they had not been involved in planning the nature of water system that they could sustain and had not received the pertinent training to uphold and manage the water supply. The scope to which constituents of the community were made responsive to the project's rationale and benefits also occupied a critical position in influencing success or failure.

Specific concerns in the area which should be emphasized are the issues around the management of funds and expenditure and the other challenges the communities have faced over time; example dry boreholes, pump breakdowns and borehole vandalized by wire cutters, digging up of water pipes and shaping them for quivers in arrows, walking over long distances to access water among others. Where problems of mistrust already exist between water management and members' complicated politics, the better option is of a private operator, with a clear contract agreement that is responsible providing the service.

4.7. Case Studies of Water Supply Projects

Njoro Water Project based at Njoro Township is a successful scheme. Their borehole located at Njoro Country Club feeds a large community reservoir onsite. The scheme objective was to secure a safe and sustainable water supply system for a population of about 15,000. The scheme provides kiosk-based delivery at eight communal water points where residents collect water at a small charge as well as supplying water to individual consumers through individual connections to other households in the area. Extension of the service requires new users to pay a connection fee and be responsible for installing a water meter and household connection pipes. Breakdowns are rare and repairs are rapid (within 48 hours). The self-help group relies on user charges to cover standard operation and maintenance costs, while informal finances available from other projects help to finance major repairs and scheme expansion. Conclusively the scheme is effectively self-sustained.

At Njokerio, an area with approximately 1300 households has a borehole sunk into the deep aquifer in 1942 by water settlers using diesel to pump water into above ground reservoirs for household use and irrigation. The borehole was revived in 1985 by the community, tired of walking 3km to the river for dirty water, and in 1996-97, the Mwihoti Water Project was established. The Project involves 3 phases: 1) Rehabilitation of the borehole and installation of electric pumps; 2) Construction of distribution kiosks and installation of another 100 cubic meter tank at the community's highest point; and 3) Reticulation: gravity distribution of water through a piped network to community households. The Project is currently in Phase 3. What's remarkable is not the phased planning, nor the fact that the borehole serves around 10,000 individuals per day and waterborne disease instances are down 60%. Mwihoti is a network and an organization that has resolved to meet the water challenge not by increasing supply through the sinking of additional boreholes, but by painstakingly planning an appropriate distribution network to meet community demands.

With funding provided by Life Water Kenya and CWS, Mwihoti Njokerio has laid an impressive community water infrastructure outdone only by the social organization of project members. The borehole pumps out 5 cubic meters of water per hour, and through the booster pump, moves the water over 2 kilometers uphill to the main storage reservoir. The water flows by gravity to a series of 4 kiosks within their area of jurisdiction. At these community taps, residents are provided water during business hours at the price 5 KSh

per 20L. The fee allows the community to maintain the pumps and pay the electrical bill, as well as provide payment for the kiosk attendants, who earn 20% commission and are rotated weekly to ensure equal distribution of pay (the market kiosk can earn members over 1,000 KSh per week).

The committee of Mwihoti Project committee holds regular meetings with members, to discuss the organization and progress of the project. Mwihoti is considered a model for community water organization in the area, with broad network. Accounting at Mwihoti is intense. Checks and cross checks are frequent, and accountability the highest priority. For instance, for each morning each kiosk attendant checks by listing the date and meter reading of their site. Following a day's sales, the cash is placed in a lockbox for delivery to the treasurer, and the meter reading again recorded. In this manner, the true volume sold can be referenced against the balance. Each week, the books are taken to the chairman, who diligently cross checks the balance, and calculates the commission. The books are then presented to the auditor, an independent consultant who traces the purchases, and advises the chairman and co-chair on fees due and savings recommended.

According to a personal communication with a key informant, the issue in Barut is not boreholes, and is not water. There are seven boreholes, with six currently functioning; three are colonial relics, handed over with zero training to the local community. All of the recently drilled boreholes drilled by faith-based NGOs associated with Life Water Kenya. The non-operational borehole was vandalized during 2008 Post election violence, a result of resource conflict under the guise of ethnic violence. Near the top of the catchment at Kamasai, there is borehole pump system that moves water to very summit of the catchment. There, a series of reservoirs are poised to gravity deliver naturally filtered water to the Barut area. Yet, it supplies a only a few kiosks and cattle troughs due to limited storage, distribution network, and inadequate pump power (5 HP). The main issue indeed is the power and distribution network. With adequate and properly planned piping, water could be delivered to every household in the area from a single borehole, if the sufficient water could be moved to the tanks. The water supply is not limiting, it is the administrative and organizational capacity of the communities themselves that is lacking to coordinate a wide water distribution plan.

But material modernization and provision by donors goes beyond the capability for authentic community utilization. Essentially, there is an evolution in the culture from river water users to groundwater users to a more modernized piped network. While evolution can be swift, for example, the installation of a borehole and construction of kiosks giving river waters a new source, the ecological shock can be unexpected. Women collect water at the river, and in general, utilize that time for valuable social interaction. A shift to a kiosk allows for comparable interaction, but the confines of a less confidential environment. Again a change to a household piped organization destroys the social framework of water collection, and though well intended, can literally bring animosity upon the donor, and ill will upon the investment. The change must be gradual, and accompanied by education, discussion, deliberation, and adaptation.

In summary this study envisions that for the newly established water schemes to attain technical; and financial feasibility, there is need for government to support WSPs' and WSBs' tariff reviews annually and also WASREB's performance monitoring programs. This regulatory and oversight assures financial flow required for the continuous operational and maintenance requirements at post construction period and hence provides the center-post for sustainability of the water supply schemes. The tariffs should be designed in a manner that ensures efficiency of the water supply schemes, watershed conservation and financial sustainability and are set in an equitable way that provides affordable services to the poor. Moreover, governance intervention should address matters of customer orientation, and efficiency in metering and billing.

5. Conclusions

The study has established that resident communities of the watershed largely depend on community managed water supply schemes. These systems are largely run on the basis of water committees. It may be argued that the approach as it is currently practiced is not a viable option for poor communities as project sustainability was found to be impacted upon largely by poverty. The management options are usually discussed with the member community and sector leadership and the strengths and weaknesses of each underlined, so that informed options can be made by the members on what best suites their community. However, it must be noted that for many rural communities in Kenya, community based management approach supplemented by government financial intervention is a must adopt; but must be pursued through in a sustainable manner.

Sustainability is impacted by a wide range of issues, including community internal dynamics, project design influences and external context as well. The study revealed that better sustained water services are significantly associated with a better gender- and poverty-sensitivity in demand-responsive schemes, user community management over project implementation, sharing of burdens and advantages during operations, and community satisfaction. However, the manner of contribution should be constricted to lead to effectively sustained services. The management at a minimum should have the baseline skills of community management and specific care is required to maintain simple record keeping where most members are illiterate.

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